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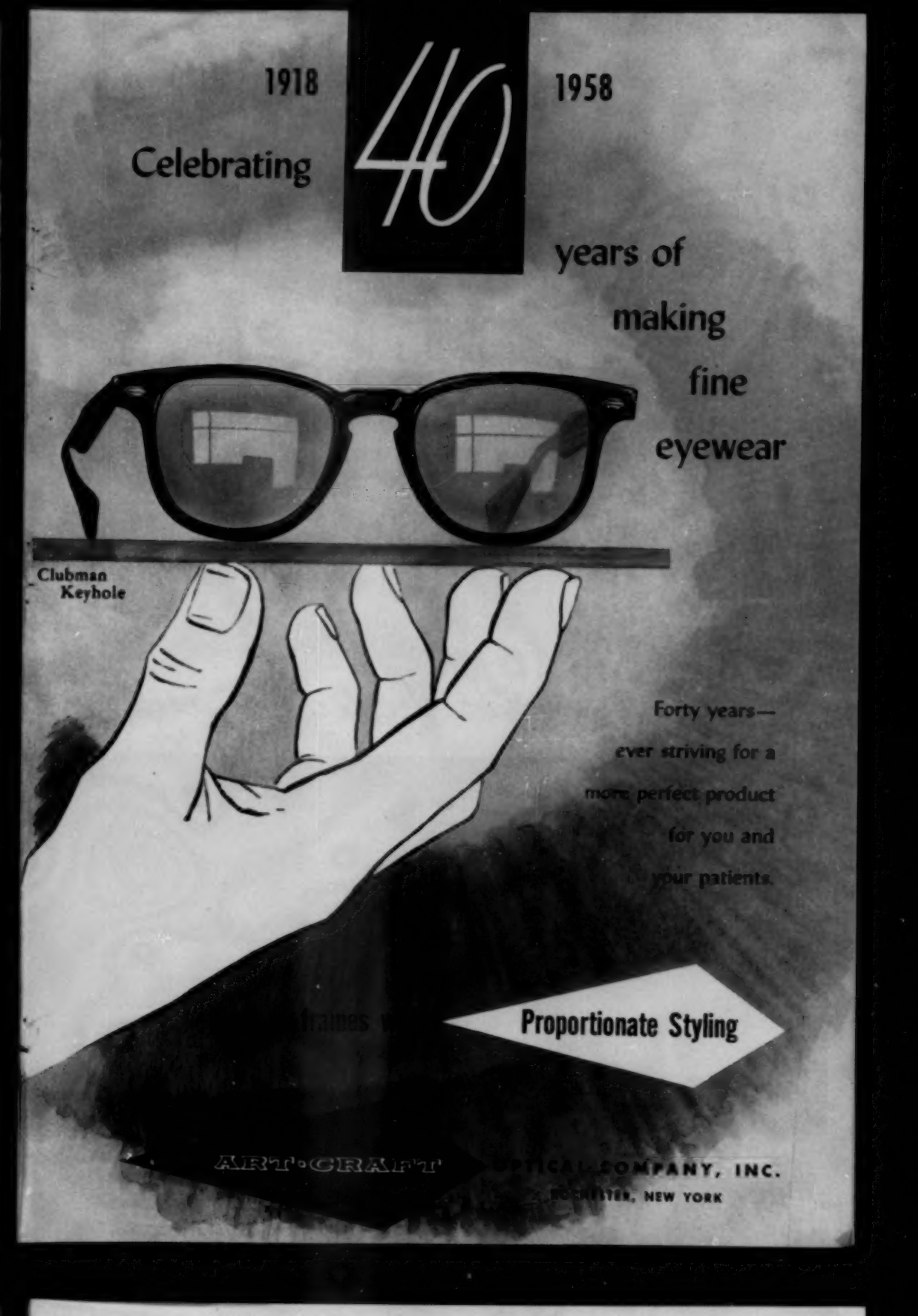
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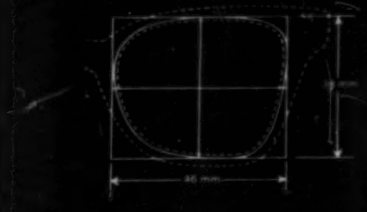

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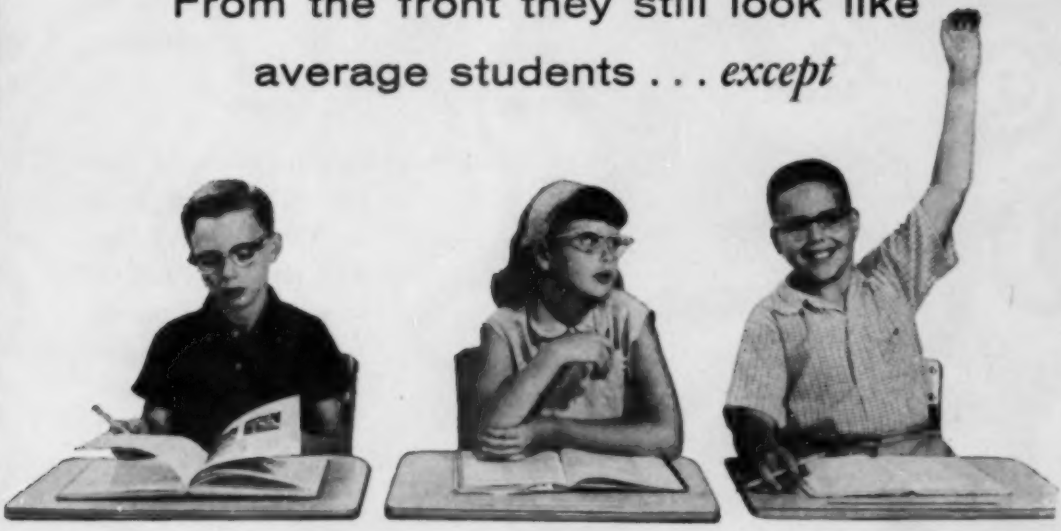

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36 (37x30)	18-20
38 (39x32)	18-20-22
40 (41x34)	18-20-22

SOLID COLORS: Pink, Demi-Amber, Demi-Blonde, Redwood, Blackwood, Charcoal Brown, Tuxedo Blue. **TWO-TONE with CRYSTAL:** Demi-Amber, Demi-Blonde, Cordovan, Redwood, Blackwood, Charcoal Brown, Tuxedo Blue. **CLEAR BRIDGE:** Redwood CB, Blackwood CB, Charcoal Brown CB, Tuxedo Blue CB.

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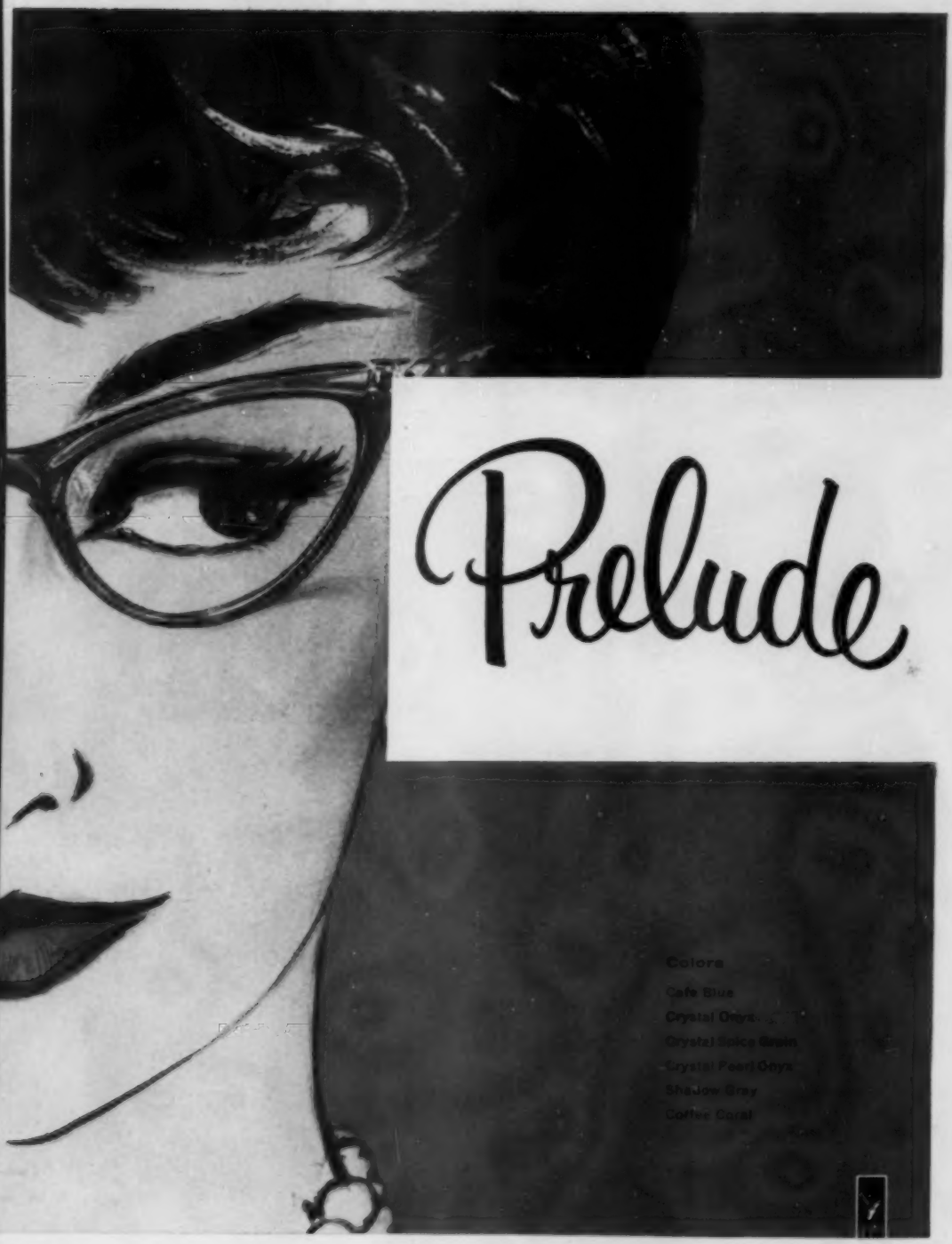
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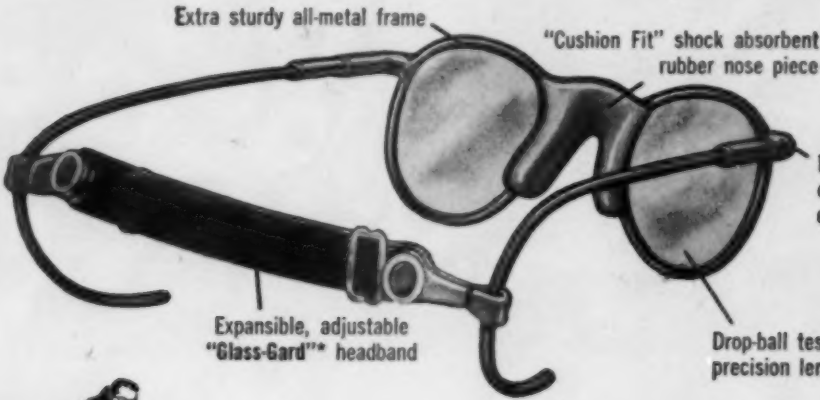
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[See page 45]

AMERICAN JOURNAL OF OPTOMETRY
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A PEDIGREE OF ARCUS JUVENILIS*

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Los Angeles, California

INTRODUCTION

In the past, arcus juvenilis has been regarded as a variant of arcus senilis, and, as such, was not differentiated by most investigators.[1, 2] A distinction was made by MacElree, but only on the age of incidence, the nature of the anomaly being considered the same in either case.[3] However, a recent investigation by Forsius has indicated that arcus *senilis* is primarily due to local senile changes in the cornea, whereas arcus *juvenilis* involves disturbances in the blood chemistry. These disturbances appear to effect lipidochemical alterations in the serum.[4] It seems generally agreed that arcus juvenilis is due to hypercholesterolemia.

The condition in either case has been described as a lipoid infiltration of the cornea, primarily Bowman's membrane, in which the droplets appear both intracellularly and extracellularly in the marginal cornea. Fatty infiltration of the contiguous sclera may also occur.[5, 6] Forsius locates the opacity in the stroma and Descemet's membrane as well, primarily in the lower parts, but notes that fatty infiltration is seldom found in Descemet's membrane.[7]

Although the term, "embryotoxon," is often used as a synonym for arcus juvenilis,[8] it is probable that this word should be reserved as the generic term for all such disturbances in fat metabolism affecting the cornea.[9] Sorsby's tendency to regard arcus juvenilis as merely an external phenomenon associated with inherited xanthomatosis of the skin and tendons[10] is therefore an example of only one of the conditions with which arcus juvenilis may be found.

Arcus juvenilis, as observed in the present pedigree, is not associated with any abnormality detectable either by external penlight examination

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The authors wish to express their gratitude to Dr. Stuart S. Kemeny, then of the Los Angeles College of Optometry, for performing most of the external and fundus examinations required in this study.
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‡Optometrist, Ph.D., Member of faculty, Fellow, American Academy of Optometry.
§Optometrist, then student at the Los Angeles College of Optometry.

or by ophthalmoscopic study of the fundus, and is probably of the type described by Forsius as a manifestation of disturbances in the fat metabolism, and regarded by almost all investigators as being without symptoms or sequelae.

The clinical picture drawn by MacElree is that of translucent, pearl-gray arcs, located superiorly and inferiorly, which gradually form a complete ring. The ring may vary from considerably less than 1 mm. to 3 mm. in width. In the pedigree about to be discussed, the well-defined rings were between 0.5 and 1.0 mm. in width. This appearance was consistent with the observation by Forsius that in persons under 40 years of age the arcus generally consists of one or two crescents, the lower one being more pronounced as a rule. In persons above the age of 40 there is a similar development of two arcs, which gradually fuse to form a complete ring.[11]

Arcus corneae appears to be a common phenomenon in the general population, with some racial and ethnic variations which may be based upon geographical location and dietary habits. Forsius' examination of 592 Finnish persons indicated a 40 per cent occurrence of arcus in persons under the age of 30, and weak arcus in 50 per cent of those under 50 years of age. For the ages above this figure estimates of the incidence of arcus range from 60 per cent on upward. However, these figures are based upon biomicroscopic examination, and would undoubtedly be much lower if only macroscopic appearances were considered. Sex differences seem well-established, with arcus developing earlier and becoming more prominent in men.[12]

Little appears to be known of the characteristics and mode of inheritance of this condition.[13] Sorsby[14] suggests its inheritance as part of the picture of xanthomatosis, and Forsius reports similar findings in the literature.[15] No pedigree is described, however, by Sorsby, nor is there much in the literature reviewed by Forsius to elucidate the hereditary transmission pattern. The present paper is therefore offered as a contribution to the establishment of such a pedigree.

In addition to the arcus juvenilis found in the family being described in this paper, several members displayed signs of color deficiency, but these defects were introduced by persons marrying into the family and were not distributed in the hereditary, sex-linked fashion characteristic of a pedigree.

PROCEDURE AND APPARATUS

Through one of the authors (TB), contact was made with members of the S-family residing in Los Angeles. Five of them were initially

examined at the Los Angeles College of Optometry in the following manner.

An external examination was made of the cornea by means of pen-light and opthalmoscope (using the +20.00 diopter auxiliary lens).

An ophthalmoscopic examination of the fundus was also performed in order to determine whether any other anomalies might be present.

Color testing was done in three ways: by means of the Ishihara test plates, by the Farnsworth-Munsell 100-Hue Test, and by the anomaloscope. The first two of these tests were carried out under illumination provided by the MacBeth Illuminant C lamp.

The results of the tests administered suggested the advisability of performing similar examinations of other members of the family, and accordingly a trip to New Mexico was undertaken for that purpose.* The same apparatus was used, with the above procedures followed.

As the Farnsworth-Munsell color test proved to be too complicated for some of the family members tested, the results of the anomaloscope and Ishihara tests were examined in order to arrive at a conclusion as to whether certain responses were indicative of a color deficiency or of a reduced but normal discriminative ability.

By these means it was ascertained that there were three clear-cut cases of deuteranomaly, of which two were exhibited by male members of the family.

In Figure 1 is shown the extensive nature of what we have labelled the S-pedigree. The circles represent females, the squares, males. Those with diagonal lines through them indicate the person is deceased. The letter P beside the square in generation IV at the right-hand side of the chart points to the *propositus*, or the person with whom the analysis started. A symbol with the upper half shaded represents *arcus;* with the lower half filled in, it signifies *deuteranomaly*. A completely black symbol means both conditions are present. Small numbers under each symbol represent the age of that member of the family.

From the pedigree, it will be seen that there are three cases of deuteranomaly, marked D_1, D_2, and D_3. D_2 is a 6 year old male, residing in Albuquerque. The defect appears in this case to have been handed down by the mother, D_1, who married *into* the S-family, and is one of those rare heterozygous women who actually manifest the defect. D_3 is the Los Angeles male whose deuteranomaly apparently was inherited

*The authors wish to thank the Southern California chapter of the American Academy of Optometry for providing the funds to make the trip possible.

FIGURE-I S-PEDIGREE

ARCUS JUVENILIS – DEUTERANOMALY

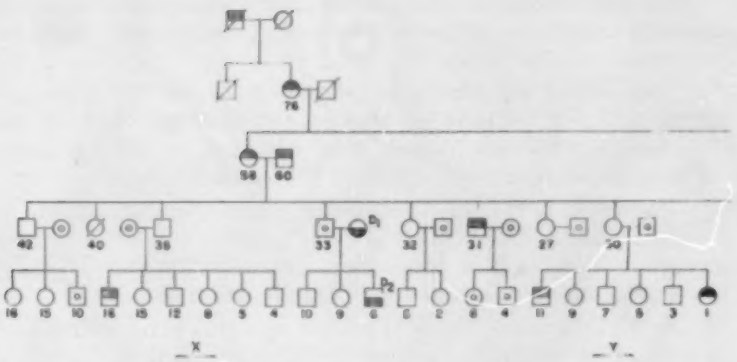


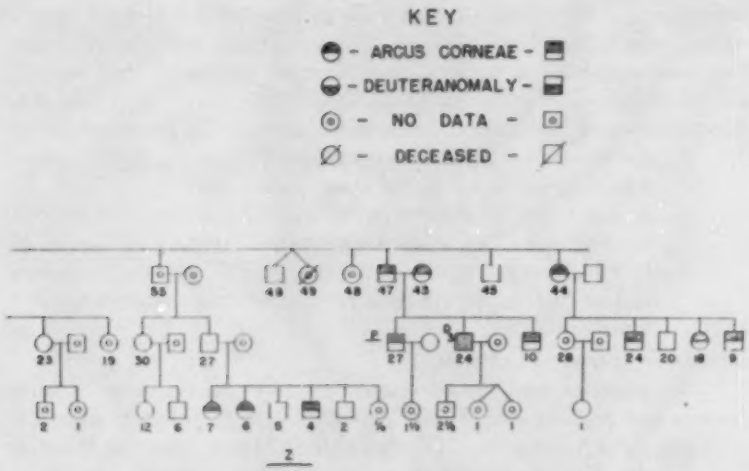
Fig 1. Continued on next page.

from a carrier mother who also married into the S-family. Since her family was unavailable for analysis, and since there appears to be no color defect in the S-family, it is necessary to assume, with Sorsby, that the mother is a carrier (heterozygous), though not manifesting any evidence of the defect herself.[16]

The distribution of arcus in the pedigree is widespread from generation II onward, appearing in both males and females. In the case of those members who are children, it is, of course, easy to denote this as arcus juvenilis. With the adults, there is no way of knowing whether the arcus is one of senilis or juvenilis, except by arbitrarily making some dividing line based on age. Family recollections proved inadequate in determining whether the adults had shown the condition as children.

In generation II, the female, age 76, shows an arcus. In generation III, all of whose members are above 40 years of age, there are three instances of arcus in the family, and two cases among those marrying into the family. In generation IV, there are seven cases of arcus, all in persons under 40, the oldest being 31. In each case, one or both parents also displayed the condition.

In generation V, however, there occur three separate families, labelled X, Y, and Z, in which arcus appears in the children but not in the parents. In this group of children, it is seen that the oldest is 16 and the youngest only one year old. It is, of course, too early to get a com-



plete picture of generation V. The fact that the arcus skips a generation in some branches of the pedigree suggests that, if this is a dominant trait, it is irregularly so.

In generation IV, the frequency of arcus is 7 cases in 16; in generation V, it is 6 cases in 26. That is, 13 of 42 members in these two generations, or roughly 31 per cent, exhibit the condition. In the Los Angeles branch of the family, all three of the sons of the affected father display a marked arcus. (The members of generation V in this group were too young to be examined.) A photograph taken of the father showed a clearly demarcated superior and inferior arc, which approach each other nasally. Because of its clear-cut nature, and because of its apparently early incidence, it may be assumed that the arcus observed in the children is inherited from the father. On the other hand, as noted, the color defect found in one of the three children is probably inherited from the mother.

It is suggested, therefore, that this pedigree of arcus juvenilis portrays it as an irregular dominant autosomal trait. The apparently low incidence of arcus may be due to the fact that no biomicroscopic analysis was made. Such an analysis, as was shown in the work of Forsius, yields evidence of arcus which is not visible on external inspection. It is therefore quite possible that the incidence in the pedigree is greater than the 31 per cent noted above.

One final observation should be made. Inspection of the members of the Albuquerque branch of the family disclosed a high frequency

of pinguecula. Because of the dusty, windy location in which the family resides, this is not too surprising. Forsius briefly notes some scanty literature suggesting a possible association of pinguecula and arcus,[17] an observation also made by Duke-Elder.[18] However, it is felt that this would not be the cause of arcus in the pedigree for three reasons:

1. Arcus was not present in many members of the family, all of whom were subject to the same environment.
2. It was found in children who had not been exposed to these conditions as long as adults who did not manifest the arcus.
3. It was most prominent in the members of the family residing in Los Angeles, where these environmental conditions are at a minimum.

SUMMARY AND CONCLUSIONS

Investigation was carried on to determine the incidence of arcus corneae and possible related color defects in a large pedigree, termed in this paper the S-pedigree. Members of this family were examined in Los Angeles, California, and Albuquerque, New Mexico.

Detection of the arcus and any other physical anomalies was accomplished by means of a pen-light and ophthalmoscopic examination. Color testing was carried out with the Ishihara color test plates, the anomaloscope, and the Farnsworth-Munsell 100-Hue test.

Analysis of the results seems to indicate that the arcus juvenilis is inherited as an irregular dominant autosomal trait. The color defect found in two males and one female of the pedigree was introduced into the family by marriage. In each case the defect was that of deuteranomaly, in one instance transmitted by the mother who was herself a deuteranomalous color observer, and in the other instance by the mother who is deduced to be the carrier.

As a concluding note the interesting hypothesis may be raised that, if the arcus juvenilis is caused by an abnormal fat matabolism, and if the arcus is hereditary in nature, then perhaps this type of fat metabolism, characterized by a hypercholesterolemia, may also be inherited.

950 WEST JEFFERSON BLVD.
LOS ANGELES 7, CALIFORNIA

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8. MacElree, loc. cit.
9. Cf. Duke-Elder, op. cit., p. 1286.
10. Sorsby, op. cit., p. 210.
11. Duke-Elder, op. cit., p. 1994.
12. Forsius, op. cit., pp. 35-36.
13. See Duke-Elder, op. cit., p. 1286.
14. Sorsby, op. cit., p. 210.
15. Forsius, op. cit., pp. 11-12.
16. Sorsby, op. cit., pp. 160-163.
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18. Duke-Elder, op. cit., p. 1994.

ANNOUNCEMENT

CONTACT LENS ASSOCIATION FOR OPTOMETRY

The Contact Lens Association for Optometry announces the Northwestern Optometric Contact Lens Conference slated for February 9 and 10 at the Olympic Hotel in Seattle, Washington. The conference represents the first of a series of regional meetings. At the meeting the speakers will be Dr. C. Edward Williams, Denver; Dr. George N. Jessen, Chicago; Dr. T. Toda, Seattle; Dr. Paul Wallen, Seattle; Dr. Roy B. Clunes, Albany, Oregon; Dr. E. W. Lenzen, Chicago, and Dr. Wayne Martin, Seattle.

Four other conferences are planned as follows: St. Louis, March 9-10, Jefferson Hotel; Oklahoma City, April 13-14, Huckins Hotel; Atlanta, May 25-26, Atlanta-Biltmore Hotel, and Denver, June 1-2, Brown Palace Hotel. Further information may be had by writing the association, 59 East Madison St., Chicago 3.

THE ABERRATIONS OF OPHTHALMIC LENSES*

Edwin W. Bechtold†
Middle Village, New York

Although a great deal has been written concerning the aberrational properties of ophthalmic lenses, most of the material is of a qualitative or descriptive nature. Henker[1] has published tables giving the marginal powers of spherical lenses for various base curves, and some American manufacturers of lenses have published data for one or two forms of compound lenses, but there does not appear to exist any comprehensive quantitative data giving the marginal properties of all of the usual forms of both spherical and compound lenses. It is the purpose of this paper to present these data for those interested ophthalmic practitioners.

There are seven principal aberrations in any optical system. These are:

Spherical aberration
Coma
Astigmatism
Curvature of field
Distortion
Longitudinal chromatic aberration
Transverse chromatic aberration

Both the spherical aberration and the coma in a single lens depend upon the shape of the lens and the diameter of the bundle of rays. The ray bundle used at any one time for a single direction of gaze is limited by the pupil of the eye, and since this aperture is relatively small, both of these aberrations are usually negligible. Even in lenses of very high power, the difference in focus between the marginal and paraxial rays is small. For example, in a —20 diopter plano concave lens, the spherical aberration for a 5 mm. pupil amounts to .21 D. Although a simple measure of coma in dioptral terms is difficult, the significance of this aberration is also slight. In the selection of the best form of spectacle lens, both of these aberrations are justifiably ignored.

Both of the chromatic aberrations depend essentially on the material of which the lens is constructed. The longitudinal chromatic aberra-

*Read before the annual meeting of the American Academy of Optometry, Houston, Texas, December 9, 1956. For publication in the January, 1958, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.
†Optometrist, M.A., Fellow, American Academy of Optometry.
[1]Henker: Introduction to the Theory of Spectacles, Jena 1924.

tion, which is the difference in lens power for the red and the blue light of the spectrum, is given by the formula

$$\Delta F = \frac{F}{V}$$

where F is the dioptral power of the lens and V is the reciprocal dispersion value of the optical material used for the lens. For ordinary spectacle crown glass, the V-value is 58.6, hence the difference in the refracting power for red and blue light, ΔF is approximately .017 diopters per diopter of lens power. In the case of negative lenses, this aberration will tend to correct the chromatic aberration of the eye (approximately 1 diopter). In general, this aberration is of little consequence in the performance of ophthalmic lenses.

When light passes obliquely through the edge of a lens a prismatic effect is created, which can be determined by Prentice's rule, i.e., deviation $= h \times F$, where h is the distance from the optical center of the lens at which an oblique ray strikes, and F is the refracting power of the lens. If h is expressed in centimeters and F in diopters, the deviation will be in prism diopters (Δ). The dispersion in a prism is given by the equation

$$\text{Dispersion} = \frac{\text{Deviation}}{V}$$

where the dispersion is the angular difference in direction between the red and blue rays, and V has its usual meaning. As a numerical example, let us determine the dispersion when we look 15 mm. off the optical center of a —10 D. lens made of ordinary crown glass. The prismatic deviation would be $1.5 \times 10 = 15\Delta$. The dispersion would be $15\Delta/58.6$ or aproximately $.25\Delta$. Since one prism diopter equals about 34 minutes of arc, the dispersion would amount to about 8 minutes of arc. The only way in which the magnitude of the dispersion can be substantially decreased is by the use of compound lenses (impractical in general) or by the use of glasses or other substances with higher V numbers (unknown at present). It should be noted that the use of "thin-lite" glass (flint glass, $V = 30$, frequently used in high minus lenses) will substantially double the amount of transverse chromatic aberration.

To determine the astigmatism, curvature of field and distortion most precisely, trigonometric ray tracing is employed. The method used to obtain the results shown in this paper is as follows: First the path of a ray in a principal meridian is traced at an angle of 30° from

the optical axis, backward through the lens from an assumed location of the center of rotation of the eye. (Figure 1.) At each surface, the ray tracing equations are:

$$\sin a'_2 = \frac{L'_2 - r_2}{r_2} \sin \theta'_2 \qquad \theta_2 = \theta'_1;\ L'_1 = L_2 + d$$

$$\sin a_2 = \sin a'_2 / n \qquad \sin a'_1 = \frac{L'_1 - r_1}{r_1} \sin \theta'_1$$

$$\theta_2 = \theta'_2 + a'_2 - a_2 \qquad \sin a_1 = n \sin a'_1$$

$$L_2 = r_2 \frac{\sin a_2}{\sin \theta_2} + r_2$$

where L and L′ refer to the distance from the vertex of the surface to the intersection of the ray before and after refraction with the axis: a is the angle of incidence, a' is the angle of refraction, θ is the angle between the ray and the optical axis before refraction, θ' is the angle between the ray and the optical axis after refraction, r is the radius of curvature of the surface, d is the axial thickness of the lens and n is the index of refraction of the glass (Figure 2). The subscripts 1 and 2 refer to the first and second surfaces, respectively.

After the path of the principal ray is traced, the focus of a small bundle of rays around the oblique ray is traced in two planes: the tangential plane (the plane of the diagram in Figure 1), and the sagittal plane (perpendicular to the plane of the diagram). The following equations are used:

For the sagittal plane:

$$\frac{n}{s'_1} = \frac{1}{s_1} + \frac{n \cos a'_1 - \cos a_1}{r_1}$$

$$s_2 = s'_1 - b$$

$$\frac{1}{s'_2} = \frac{n}{s_2} + \frac{\cos a'_2 - n \cos a_2}{r_2}$$

For the tangential plane:

$$\frac{n \cos^2 a'_1}{t'_1} = \frac{\cos^2 a_1}{t_1} + \frac{n \cos a'_1 - \cos a_1}{r_1}$$

$$t_2 = t'_1 - b$$

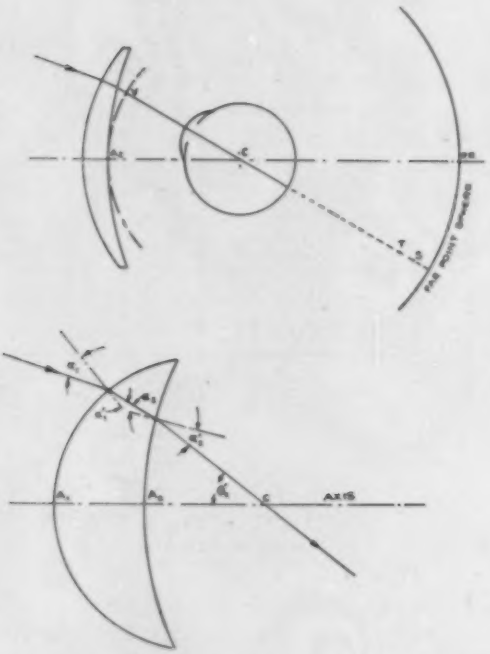


Fig. 1. Top. Diagram showing an oblique principal ray, the position of the vertex sphere and the far point sphere.

Fig. 2. Bottom. Refraction of a ray through a convex meniscus lens.

$$\frac{\cos^2 a'_2}{t'_2} = \frac{n \cos^2 a_2}{t_2} + \frac{\cos a'_2 - n \cos a_2}{r_2}$$

The quantity b is the oblique thickness, determined as follows:

$$b = \frac{d - r_1 [1 - \cos (\theta_1 + a_1)] + r_2 [1 - \cos (\theta_2 + a_2)]}{\cos \theta_2}$$

The final refracting power of the lens in the oblique direction is not given in terms of the rear surface, since the quantity we are interested in comparing with the axial vertex power should be measured with respect to the same reference point, i.e., from a point at the same distance from the center of rotation of the eye as the vertex of the lens (point V, Figure 1).

In all of the computations, it has been assumed that the index of

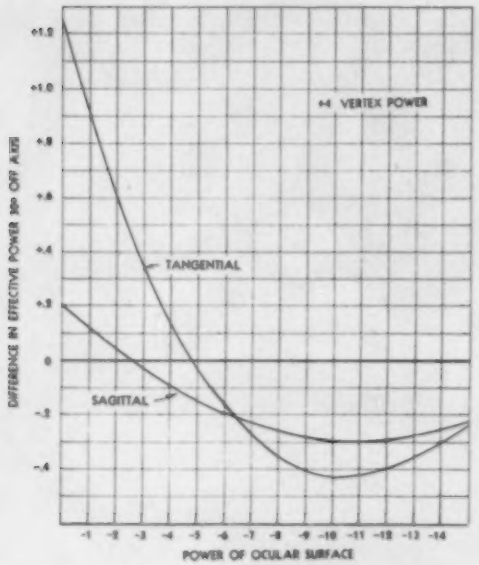


Fig. 3. Top. Graphic representation of the tangential and sagittal foci around an oblique ray for a lens of +4 D. back vertex power. (Distant object.)
Fig. 4. Bottom. Representation of a toric surface.

refraction of the glass is 1.523 (standard spectacle crown), and the rear vertex of the lens will be placed 27 mm. from the center of rotation of the eye (a corneal distance of about 13.5 mm.). The results of a typical computation show, for example, that a +4 D. vertex power sphere, having a 3.5 mm. center thickness and an inside curve of —2 D., has an oblique refracting power in the tangential plane of +4.5987 D., and a power in the sagittal plane of +4.0305 D. Such a lens, therefore, is the equivalent of a +4.03 D.S. +.57 D.C. when the gaze is directed through a point about 15 mm. away from the

Vertex Power	Inside Curve		POWER OF OCULAR SURFACE													
			+1.	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14
+8	5.3	Tan.	+9.03	+8.60	+8.03	+8.67	+8.20	+8.68	+7.30	+7.79	+7.35	+7.75	+7.80	+7.91	+8.01	+8.26	+8.53
		Sag.	+8.23	+8.30	+7.99	+7.77	+7.70	+7.50	+7.68	+7.62	+7.61	+7.61	+7.60	+7.65	+7.70	+7.76	+7.84
+7	6.2	Tan.	+8.77	+8.79	+7.83	+7.52	+7.78	+7.80	+6.53	+6.73	+6.84	+6.60	+6.65	+6.71	+6.80	+6.95	+7.10
		Sag.	+7.23	+7.30	+6.96	+6.39	+6.80	+6.74	+6.66	+6.65	+6.67	+6.62	+6.68	+6.64	+6.67	+6.72	+6.77
+6	6.2	Tan.	+7.62	+7.38	+6.75	+6.62	+6.17	+5.97	+5.81	+5.69	+5.62	+5.56	+5.57	+5.62	+5.69	+5.80	+5.93
		Sag.	+6.39	+6.30	+6.08	+5.80	+5.83	+5.77	+5.72	+5.68	+5.68	+5.63	+5.63	+5.64	+5.66	+5.69	+5.73
+5	3.8	Tan.	+6.46	+6.05	+5.66	+5.60	+5.35	+4.96	+4.82	+4.69	+4.62	+4.56	+4.55	+4.57	+4.61	+4.66	+4.71
		Sag.	+5.71	+5.38	+5.02	+4.93	+4.86	+4.80	+4.75	+4.71	+4.69	+4.67	+4.66	+4.67	+4.68	+4.70	+4.72
+4	3.8	Tan.	+5.25	+4.91	+4.60	+4.35	+4.34	+3.97	+3.84	+3.73	+3.65	+3.60	+3.57	+3.57	+3.60	+3.66	+3.70
		Sag.	+4.70	+4.33	+4.03	+3.96	+3.90	+3.85	+3.80	+3.77	+3.75	+3.72	+3.71	+3.70	+3.71	+3.72	+3.76
+3	3.2	Tan.	+4.07	+3.77	+3.50	+3.31	+3.34	+3.00	+2.96	+2.76	+2.73	+2.66	+2.63	+2.62	+2.62	+2.65	+2.70
		Sag.	+3.56	+3.30	+3.04	+2.96	+2.98	+2.89	+2.85	+2.82	+2.80	+2.79	+2.77	+2.75	+2.75	+2.75	+2.77
+2	2.2	Tan.	+2.75	+2.56	+2.39	+2.24	+2.33	+2.00	+1.97	+1.85	+1.79	+1.75	+1.72	+1.70	+1.70	+1.71	+1.73
		Sag.	+2.24	+2.08	+1.94	+1.90	+1.96	+1.93	+1.90	+1.90	+1.88	+1.86	+1.83	+1.82	+1.82	+1.82	+1.82
+1	2.2	Tan.	+1.61	+1.31	+1.17	+1.14	+1.06	+1.00	+.95	+.90	+.87	+.83	+.81	+.80	+.79	+.79	+.80
		Sag.	+1.05	+1.05	+1.02	+1.00	+.98	+.96	+.95	+.93	+.92	+.92	+.91	+.89	+.89	+.89	+.89
±0.	2.0	Tan.	.00	.00	-.01	-.01	-.02	-.03	-.04	-.05	-.05	-.05	-.05	-.07	-.07	-.07	-.07
		Sag.	.00	.00	.00	.00	-.01	-.02	-.01	-.02	-.02	-.02	-.02	-.02	-.02	-.02	-.03
-1	1.6	Tan.		-1.39	-1.29	-1.19	-1.25	-1.09	-1.05	-1.02	-.99	-.97	-.95	-.94	-.93	-.92	-.92
		Sag.		-1.07	-1.05	-1.02	-1.00	-.99	-.99	-.97	-.97	-.97	-.96	-.95	-.95	-.96	-.96
-2	1.2	Tan.			-.66	-.63	-.53	-.50	-.50	-.50	-.49	-.49	-.49	-.49	-.48	-.48	-.49
		Sag.			-.53	-.50	-.05	-.03	-1.97	-1.95	-1.93	-1.91	-1.90	-1.89	-1.88	-1.88	-1.88
-3	.8	Tan.				-1.04	-1.56	-1.30	-1.21	-1.06	-1.04	-1.04	-1.03	-1.03	-1.03	-1.03	-1.03
		Sag.				-1.16	-1.09	-1.04	-1.04	-1.04	-1.04	-1.03	-1.03	-1.03	-1.03	-1.03	-1.03
-4	.8	Tan.					-2.13	-1.51	-1.19	-1.17	-1.09	-1.04	-1.03	-1.03	-1.03	-1.03	-1.03
		Sag.					-1.37	-1.19	-1.03	-1.01	-1.01	-1.01	-1.01	-1.01	-1.01	-1.01	-1.01
-5	.7	Tan.						-2.17	-1.62	-1.31	-1.19	-1.09	-1.05	-1.03	-1.03	-1.03	-1.03
		Sag.						-1.16	-1.06	-1.02	-1.02	-1.01	-1.01	-1.01	-1.01	-1.01	-1.01
-6	.7	Tan.							-1.96	-1.58	-1.36	-1.19	-1.11	-1.07	-1.05	-1.04	-1.04
		Sag.							-1.25	-1.03	-1.03	-1.03	-1.03	-1.03	-1.03	-1.03	-1.03
-7	.7	Tan.								-2.93	-1.93	-1.53	-1.33	-1.23	-1.17	-1.14	-1.13
		Sag.								-1.32	-1.16	-1.05	-1.04	-1.04	-1.04	-1.04	-1.04
-8	.7	Tan.									-3.03	-2.30	-1.88	-1.63	-1.49	-1.40	-1.36
		Sag.									-1.49	-1.17	-1.07	-1.05	-1.05	-1.05	-1.05

Table 1. Tangential and sagittal power of spherical lenses from +8 D. to —8 D. Vertex power for various inside curvatures. (Distant object.)

optical center of the lens. Since the tangential plane is the plane determined by the optical axis of the lens and the oblique ray, the resulting cylinder would be axis 180 when the eye is looking up or down, and axis 90 when looking right or left of center.

If this process is repeated for a slope angle of 15° instead of 30°, it is found that the departures from +4 D. in the tangential and saggital directions are only about 1/4th as great. In general, the difference between the axial power and the power in a direction of gaze will vary as the square of the angle.

The process for a 30° angle was repeated for a +4 D. vertex power sphere, using inside curves of 0, —4, —6, —8, —10, —12 and —14 diopters. The results are shown graphically in Figure 3. The tangential and sagittal powers for intermediate values of the inside curve can be determined with sufficient accuracy from the graph.

This entire process was then repeated for other lens powers. Rather than present the data in 29 graphs similar to Figure 3, we have tabulated the results for spherical lenses between +8 D. and —8 D. in Table 1, and from —9 D. to —20 D. in Table 2.

In Figure 3, the point at which the two curves intersect gives the inside curvature for which the oblique powers are the same, i.e., the

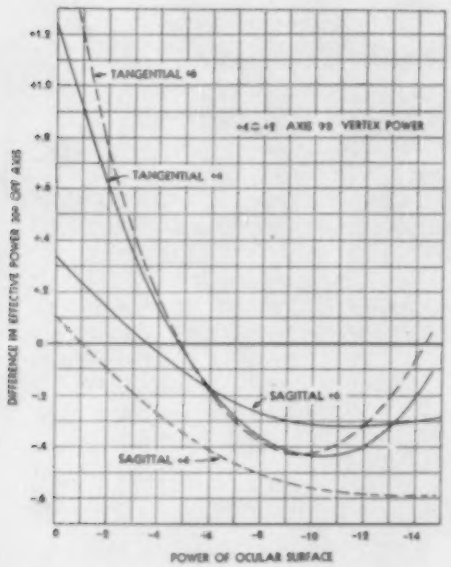


Fig. 5. Top. Graphic representation of the tangential and sagittal foci of a front toric lens having a back vertex power of +4 D.S. ⌣ +2 D.C. axis 90. The solid curves represent the defects when looking 30° up or down from the optical axis. The dotted curves correspond to a sidewise direction of gaze.

Fig. 6. Bottom. Diagram of an oblique ray from a near object point.

anastigmatic form of lens. In general, there are two forms of anastigmatic lenses, the shallower form corresponding to what is called the "Ostwalt" lens, and the more steeply curved lens being known as the "Wollaston" form. As most practitioners know, it is the Ostwalt form that is usually of principal interest.

Excepting the —20 D. and zero vertex power lenses, the anastigmatic form of lenses throughout the range described have an oblique

V.P.	C.P.		POWER OF OCULAR SURFACE											
			-9	-10	-11	-12	-13	-14	-15	-16	-17	-18	-19	-20
-9	.6	Tan.	-9.73	-9.33	-8.86	-8.47	-8.26	-8.10	-7.92					
		Sag.	-9.05	-8.96	-8.72	-8.68	-8.58	-8.52	-8.47					
-10	.6	Tan.	-10.62	-10.62	-10.12	- 9.71	-9.37	-9.11	-8.91	-8.77				
		Sag.		-10.02	-9.65	-9.72	-9.61	-9.52	-9.45	-9.42				
-11	.6	Tan.			-11.50	-11.03	-10.56	-10.26	- 9.96	-9.85	-9.63			
		Sag.			-10.97	-10.81	-10.66	-10.56	-10.49	-10.42	-10.36			
-12	.6	Tan.				-12.38	-11.85	-11.62	-11.28	-10.82	-10.63	-10.51		
		Sag.				-11.94	-11.77	-11.69	-11.58	-11.43	-11.36	-11.39		
-13	.6	Tan.				-13.93	-13.26	-12.77	-12.29	-11.95	-11.70	-11.51	-11.42	
		Sag.				-13.13	-12.91	-12.73	-12.59	-12.49	-12.39	-12.33	-12.30	
-14	.6	Tan.				-15.47	-14.85	-14.36	-13.60	-13.37	-13.17	-12.83	-12.59	-12.43
		Sag.				-14.38	-14.12	-13.89	-13.70	-13.56	-13.46	-13.37	-13.31	-13.29
-15	.6	Tan.				-17.66	-16.63	-15.77	-15.07	-14.50	-14.07	-13.75	-13.53	-13.38
		Sag.				-15.70	-15.38	-15.11	-14.88	-14.70	-14.55	-14.44	-14.37	-14.32
-16	.6	Tan.				-19.96	-18.67	-17.58	-16.71	-16.00	-15.44	-15.00	-14.67	-14.44
		Sag.				-17.10	-16.82	-16.60	-16.37	-16.20	-16.06	-15.96	-15.86	-15.77
-17	.6	Tan.				-22.69	-21.03	-19.67	-18.57	-17.65	-16.96	-16.38	-15.97	-15.67
		Sag.				-18.54	-18.24	-17.99	-17.83	-17.19	-16.89	-16.70	-16.58	-16.46
-18	.6	Tan.				-26.03	-23.90	-22.13	-20.70	-19.59	-18.68	-17.95	-17.39	-16.97
		Sag.				-20.06	-19.92	-19.39	-18.95	-18.67	-18.38	-18.12	-17.93	-17.80
-19	.6	Tan.						-25.09	-23.28	-21.82	-20.65	-19.72	-18.96	-18.42
		Sag.						-21.94	-20.42	-19.98	-19.53	-19.22	-18.98	-18.79
-20	.6	Tan.						-28.88	-26.42	-24.47	-22.94	-21.74	-20.78	-20.05
		Sag.						-23.09	-22.20	-21.54	-21.03	-20.63	-20.28	-20.05

Table 2. Tangential and sagittal power of spherical lenses from —9 D. to —20 D. Vertex power. (Distant object.)

power that is weaker than the axial power. This corresponds to what is usually called curvature of field in other types of optical systems. In the case of the +4 D. sphere, the anastigmatic form (inside curve of about —6.5 D.) is about 1/4 D. weaker for an oblique direction of gaze. In the lower power lenses, this departure is smaller. It may be noted from the data that in lenses of low or moderate power, there is a considerable range of coflexure for which the performance is quite acceptable.

The problem in toric lenses is somewhat more complicated because, unlike spheres, toric surfaces are not surfaces of constant curvature. Let Figure 4 be the representation of a toric surface generated by rotating the circle AH about the axis C'_pC_p. At the point A the principal radii of curvature will be AC_s and AC_p. At a point V on the surface, the curvatures in the principal directions will be exactly the same. This is true for all points on the surface along the curve AV. However, at a point H, although the radius of curvature in the horizontal direction is $HC_s = AC_s = VC_s$, the radius of curvature in the vertical direction is HC'_p, which is longer than AC_p. For example, if the two principal radii of curvature at the point A were 54.03 mm. and 39.12 mm., respectively, at the point H (about 15 mm. from the point A) although the radius of curvature in the horizontal plane would still be 39.12 mm., the radius of curvature in the vertical direction would be

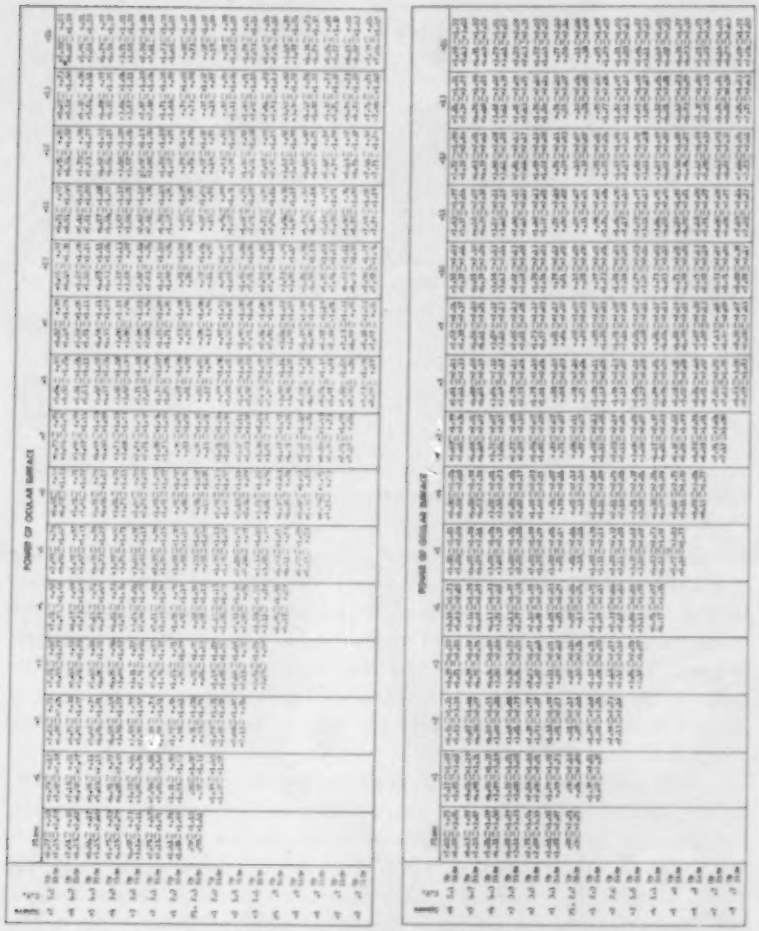


Table 3. Left. Effectivity of front toric lenses when looking 30° up or 30° sidewise from the optical axis for various powers of sphere combined with a +1 D.C. axis 90. Table 4. Right. Effectivity of front toric lenses for various powers of sphere combined wtih a +2 D.C. axis 90.

55.52 mm. As we shall see later, this change in radius, and consequently surface power, adversely affects the performance of even the best forms of compound lenses.

The results of a typical computation show for a +4 D.S. ⌒

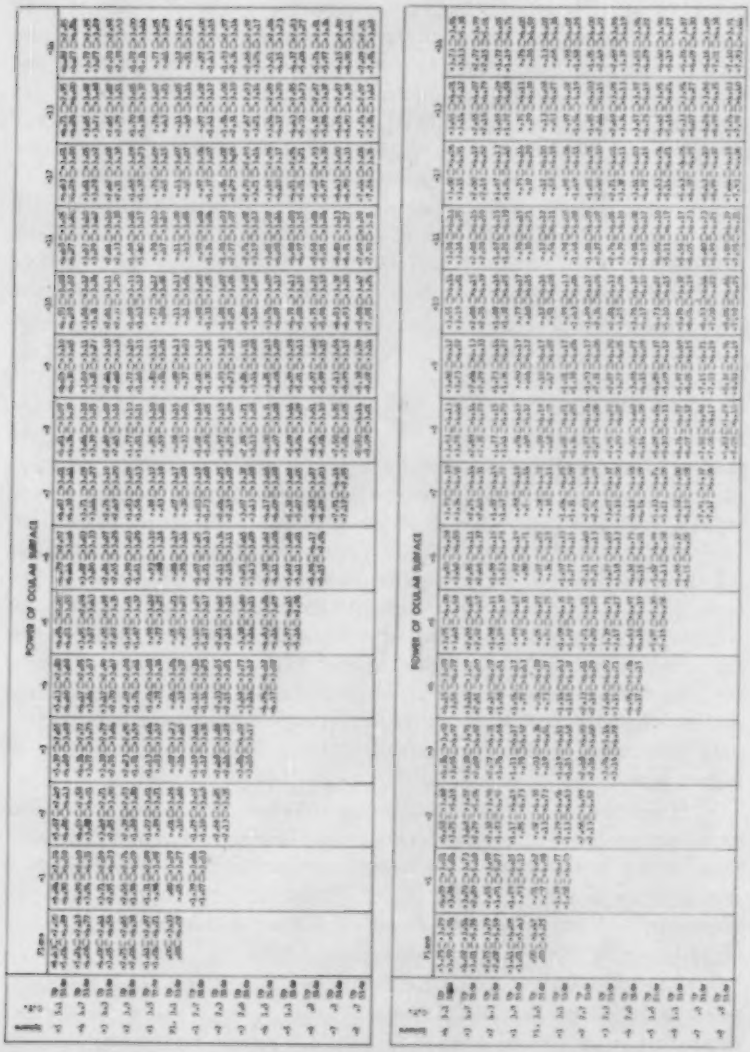


Table 5. Left. Effectivity of front toric lenses of various sphere powers combined with a +3 D.C. axis 90.
Table 6. Right. Effectivity of front toric lenses of various sphere powers combined with a +4 D.C. axis 90.

+4 D.C. axis 90 ground on a spherical inside curve of —2 D., with a center thickness of 5.1 mm. (approximately an ordinary "6 base toric"), the tangential power is +4.5769 D. around the principal ray through V and the sagittal power is +8.2600 D. Around the ray through H, the tangential power is +8.9317 D., while the sagittal power is +3.7533 D. When looking up (or down) 30° from the axis of this lens, the effective power is equivalent to a +4.58 D.S. ⊂ +3.68 D.C. ax 90. When looking through the side of this lens, the effective power is equivalent to a +3.75 D.S. ⊂ +5.18 D.C. ax 90. It should be noted that if the cylinder axis originally were 180° instead of 90°, the positions of the words "up" and "side" would be reversed.

Repeating the computations for various inside curves and with various amounts of cylinder and sphere power, as was done in the case of spherical lenses, enables us to plot a graph such as is shown in Figure 5. This is the case for a +4 D.S. ⊂ +2 D.C. ax 90. Here we have two sets of curves: the solid curves coresponding to the tangential and sagittal foci for an upward (or downward) direction of gaze, and the dotted curves corresponding to the tangential and sagittal foci for a sidewise direction of gaze. The point where the two solid curves intersect (for an inside curvature of approximately 6 D.), corresponds to what in spherical lenses would be the anastigmatic form of lens. In the case of compound lenses, this would be the point where the cylindrical power for an oblique direction of gaze would be the same as the axial cylindrical power. In this particular example, the two dotted curves do not intersect, meaning that no form of lens can be found for which the cylindrical power in a sidewise direction of gaze will equal the axial cylindrical power. This is generally true in higher powers of sphero-cylinders.

It may be mentioned that there are two forms of toric surfaces possible: the so-called doughnut toric pictured in Figure 4, and a "football' toric, which would result if the axis of generation $C_pC'_p$, in Figure 4 was between A and C_s. Since all front toric curves commonly made by American lens manufacturers are of the doughnut variety, this form of surface was used in all of the computations.

The effectivity of lenses for both the upward and sideward directions of gaze have been tabulated in Tables 3, 4, 5, and 6 for various combinations of spheres with +1, +2, +3 and +4 cylinders axis 90. As in the case of spheres, an index of refraction of 1.523, a 30° angle of view, and a distance of 27 mm. from the vertex to the center of rotation of the eye are assumed.

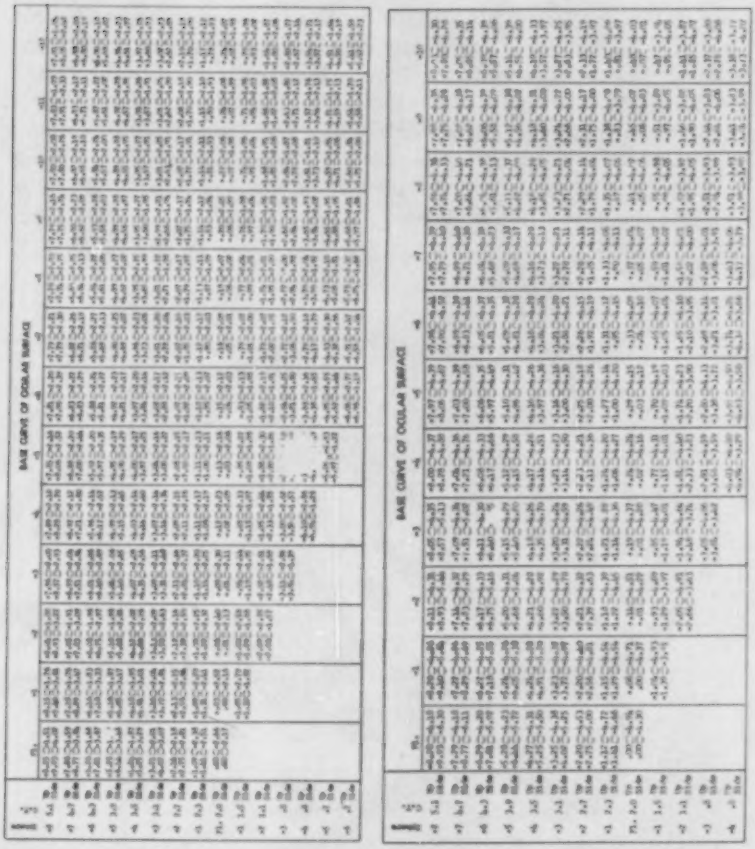
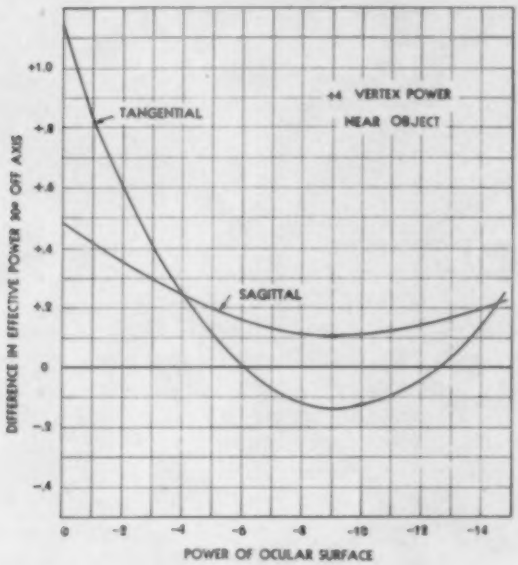


Table 7. Left. Effectivity of various sphere powers combined with a —2 D.C. axis 180 ground on various inside toric curves.
Table 8. Right. Effectivity of various sphere powers combined with a —4 D.C. axis 180 ground on various inside toric curves.

The advantage of compound lenses ground with inside toric, rather than front toric, surfaces is often questioned. The results of the computations for various powers of sphere combined with 2 and 4 D. cylinders, ground on inside torics is tabulated in Tables 7 and 8. As may be noted, these forms do not appear to have any startling advantages over the usual front toric type of single vision lenses.

In all of the computations described above, it has been assumed that the object distance was infinite, i.e., we have been discussing dis-

tance correction glasses. Let us now consider the case of lenses used for close objects. For purposes of uniformity in computation, it has been assumed that the close object was in a plane held perpendicular to the optical axis of the lens, at a distance of 1/3 meter from the center of rotation of the eye (Figure 6). The tangential and sagittal foci, using finite values of s_1 and t_1 were recomputed. The results for a lens having a +4 D. back vertex power are shown in the graph, Figure 7. It can be seen that the intersection of the two curves (anastigmatic form) occurs



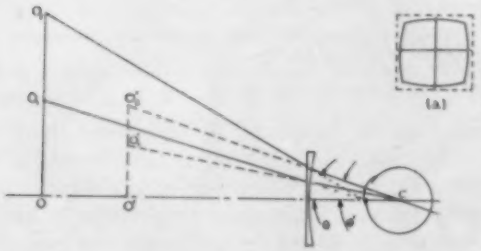


Fig. 7. Top. Graphic representation of the dioptral difference between center and margin of a +4 D.S. for a near object.

Fig. 8. Bottom. Distorting effects of spectacle lenses.

Sphere	c.c.		POWER OF OCULAR SURFACE														
			Pl.	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14
+8	5.1	Tan.	+1.44	+.99	+.65	+.39	+.18	+.04	-.06	-.10	-.06	-.01	+.11	+.27	+.47	+.75	+1.06
		Sag.	+.37	+.25	+.17	+.09	+.03	-.01	-.04	-.05	-.05	-.03	+.01	+.06	+.13	+.23	+.31
+7	4.7	Tan.	+1.35	+.96	+.61	+.35	+.15	.00	-.11	-.16	-.16	-.15	-.07	+.04	+.20	+.40	+.67
		Sag.	+.40	+.30	+.21	+.14	+.07	+.03	-.01	-.02	-.03	-.02	.00	+.05	+.10	+.16	+.23
+6	4.3	Tan.	+1.26	+.87	+.59	+.35	+.15	.00	-.11	-.18	-.20	-.19	-.14	-.06	+.05	+.20	+.39
		Sag.	+.43	+.32	+.24	+.17	+.12	+.07	+.04	+.02	+.01	.00	+.02	+.04	+.08	+.13	+.18
+5	3.9	Tan.	+1.22	+.89	+.59	+.37	+.18	+.04	-.07	-.11	-.14	-.16	-.15	-.10	-.02	+.10	+.22
		Sag.	+.46	+.37	+.29	+.23	+.17	+.13	+.10	+.07	+.05	+.05	+.05	+.06	+.10	+.14	+.18
+4	3.5	Tan.	+1.14	+.81	+.59	+.40	+.24	+.11	+.01	-.06	-.12	-.13	-.12	-.10	-.05	+.01	+.13
		Sag.	+.48	+.40	+.34	+.28	+.22	+.19	+.17	+.13	+.11	+.11	+.11	+.12	+.14	+.16	+.19
+3	3.1	Tan.	+1.05	+.80	+.57	+.40	+.29	+.18	+.08	+.01	-.04	-.05	-.05	-.04	-.01	+.03	+.10
		Sag.	+.49	+.44	+.38	+.34	+.29	+.26	+.25	+.21	+.19	+.18	+.18	+.18	+.19	+.20	+.22
+2	2.7	Tan.	+.90	+.60	+.55	+.42	+.34	+.26	+.20	+.15	+.11	+.09	+.08	+.08	+.09	+.12	+.15
		Sag.	+.50	+.45	+.42	+.39	+.36	+.34	+.31	+.29	+.28	+.27	+.26	+.26	+.26	+.27	+.28
+1	2.3	Tan.	+.70	+.61	+.52	+.45	+.39	+.32	+.30	+.27	+.25	+.24	+.23	+.23	+.24	+.25	+.27
		Sag.	+.49	+.47	+.44	+.42	+.40	+.39	+.38	+.37	+.36	+.35	+.35	+.35	+.35	+.35	+.36
Pl.	2.0	Tan.	+.47	+.46	+.45	+.44	+.43	+.42	+.41	+.41	+.41	+.41	+.41	+.40	+.40	+.40	+.39
		Sag.	+.47	+.47	+.46	+.46	+.45	+.45	+.45	+.44	+.44	+.44	+.44	+.44	+.44	+.44	+.45
-1	1.5	Tan.		-.22	+.29	+.35	+.40	+.45	+.49	+.53	+.56	+.58	+.60	+.61	+.61	+.61	+.60
		Sag.		+.45	+.45	+.47	+.48	+.50	+.51	+.52	+.53	+.54	+.54	+.55	+.55	+.55	+.54
-2	1.1	Tan.			+.10	+.25	+.38	+.48	+.56	+.63	+.67	+.71	+.74	+.76	+.77	+.77	+.76
		Sag.			+.44	+.47	+.50	+.54	+.57	+.59	+.61	+.62	+.63	+.64	+.64	+.64	+.63
-3	.8	Tan.				+.08	+.28	+.45	+.58	+.68	+.77	+.84	+.90	+.94	+.96	+.96	+.96
		Sag.				+.46	+.51	+.55	+.59	+.63	+.67	+.70	+.72	+.73	+.74	+.74	+.73
-4	.8	Tan.					+.09	+.34	+.53	+.69	+.83	+.95	+1.04	+1.12	+1.15	+1.17	+1.17
		Sag.					+.51	+.57	+.63	+.68	+.72	+.76	+.79	+.81	+.82	+.83	+.83
-5	.7	Tan.						+.24	+.49	+.65	+.85	+1.01	+1.15	+1.25	+1.32	+1.35	+1.36
		Sag.						+.59	+.62	+.69	+.75	+.82	+.85	+.89	+.91	+.92	+.92
-6	.7	Tan.							+.23	+.54	+.80	+1.04	+1.22	+1.37	+1.47	+1.54	+1.56
		Sag.							+.60	+.69	+.77	+.84	+.90	+.94	+.98	+1.00	+1.01
-7	.7	Tan.								+.36	+.71	+1.01	+1.25	+1.45	+1.59	+1.68	+1.73
		Sag.								+.67	+.76	+.84	+.92	+.99	+1.04	+1.07	+1.09
-8	.7	Tan.									+.53	+.85	+1.12	+1.36	+1.47	+1.51	+1.49
		Sag.									+.73	+.84	+.94	+1.02	+1.06	+1.13	+1.16

Table 9. Top. Difference between central and marginal effectivity of spheres from +8 D. to —8 D. for various inside curvatures. (Near object.)
Table 10. Bottom. Per cent distortion of spherical lenses of +8 D. to —8 D. vertex power as a function of inside curvature.

Sphere	c.c.	POWER OF OCULAR SURFACE														
		Pl.	-1	-2	-3	-4	-5	-6	-7	-8	-9	-10	-11	-12	-13	-14
+8	5.1	+9.7	+8.8	+8.1	+7.4	+6.7	+6.2	+5.7	+5.3	+4.9	+4.6	+4.4	+4.2	+4.1	+4.0	+4.1
+7	4.7	+8.9	+8.2	+7.4	+6.8	+6.2	+5.7	+5.2	+4.8	+4.5	+4.2	+3.9	+3.8	+3.6	+3.6	+3.5
+6	4.3	+8.1	+7.4	+6.7	+6.1	+5.6	+5.1	+4.6	+4.3	+4.0	+3.8	+3.5	+3.4	+3.2	+3.1	+3.1
+5	3.9	+7.0	+6.4	+5.9	+5.4	+5.0	+4.6	+4.2	+3.9	+3.6	+3.3	+3.1	+2.9	+2.8	+2.7	+2.7
+4	3.5	+6.0	+5.5	+5.0	+4.6	+4.2	+3.9	+3.6	+3.3	+3.1	+2.8	+2.7	+2.5	+2.4	+2.3	+2.3
+3	3.1	+4.8	+4.4	+4.0	+3.7	+3.4	+3.2	+2.9	+2.7	+2.5	+2.3	+2.2	+2.1	+2.0	+1.9	+1.8
+2	2.7	+3.4	+3.1	+2.9	+2.7	+2.5	+2.3	+2.1	+2.0	+1.9	+1.7	+1.6	+1.5	+1.5	+1.4	+1.3
+1	2.3	+1.9	+1.7	+1.6	+1.5	+1.4	+1.3	+1.3	+1.2	+1.1	+1.1	+1.1	+1.0	+1.0	+1.0	+.9
Pl.	2.0	0	+.1	+.1	+.2	+.2	+.2	+.3	+.3	+.3	+.3	+.3	+.3	+.3	+.3	+.3
-1	1.5		-1.7	-1.5	-1.4	-1.2	-1.1	-.9	-.8	-.7	-.6	-.6	-.5	-.4	-.3	-.3
-2	1.1			-3.5	-3.1	-2.8	-2.5	-2.2	-2.0	-1.8	-1.7	-1.5	-1.3	-1.2	-1.1	-1.0
-3	.8				-5.1	-4.6	-4.2	-3.7	-3.4	-3.0	-2.7	-2.5	-2.3	-2.0	-1.8	-1.7
-4	.8					-6.7	-6.0	-5.4	-4.9	-4.4	-4.0	-3.6	-3.3	-3.1	-2.7	-2.5
-5	.7						-8.2	-7.4	-6.7	-6.0	-5.5	-5.0	-4.5	-4.2	-3.8	-3.5
-6	.7							-9.7	-8.8	-7.9	-7.2	-6.5	-6.9	-5.4	-4.9	-4.6
-7	.7								-11.2	-10.2	-9.2	-8.3	-7.6	-6.9	-6.3	-5.8
-8	.7									-12.7	-11.5	-10.4	-9.3	-8.6	-7.7	-7.2

at about a —4 D. inside curve, which is about 2.5 D. flatter than for the distance glass. In general, the anastigmatic form of lens for near objects

is about 2.5 D. shallower than the corresponding lens for distant objects. The results for spherical lenses throughout the range from +8 D. to —8 D. vertex power are given in Table 9.

Let us now consider the last of the principal aberrations, Distortion. In Figure 8, any object located in a direction 0_1 will, after refraction by the lens, appear to lie in a direction $0'_1$. The question arises as to whether this same ratio of change in apparent direction will hold regardless of the direction of gaze, i.e., does $0'0'_1/00_1 = 0'0'_2/00_2$? If it does, then tan θ/tan θ' will be a constant regardless of the magnitude of θ, and the image formed by the lens will be a faithful reproduction of the object. A square object viewed through the lens will appear square. If, however, tan θ/tan θ' increases as θ increases, a square object will appear to be distorted into a barrel shape. If tan θ/tan θ' decreases as θ increases, a square will be distorted into a pin-cushion shape (Figure 8a). Although the magnitude of this distortion depends on the shape of the lens, it is virtually impossible to obtain a distortion-free spectacle lens. All positive lenses produce an apparent pin-cushion distortion, and all negative lenses a barrel (—) distortion. The per cent change in the ratio of tan θ/tan θ' for a value of $\theta' = 30°$ compared to the value of the ratio as θ' approaches zero for various powers of spherical lenses is given in Table 10. It may be noted that the forms of lenses having minimum distortion are much more highly curved than those normally used in ophthalmic practice.

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BOOK NOTICE

PRINCIPLES OF PERCEPTION. S. Howard Bartley, Ph.D. Published by Harper & Brothers. 49 E. 33rd St., New York City. 482 pages. Cloth. $6.50. 1957.

According to the publishers this is the only text dealing with human perception of its kind on the market. Most books deal with sensory material in a way detached from other facts of human behavior. The Bartley book shows that sensory and perceptual material is part of the core subject matter for psychology itself. The book, it is claimed, will be of interest to those in the field of optometry.

PLANO PROBLEMS IN A SAFETY PROGRAM*

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INTRODUCTION

Any safety program must provide protection for those employees who do not ordinarily wear spectacles as well as for those who do. The recommended protection according to Hofstetter and Kuhn is plano safety glasses.[1, 2] A small percentage of those employees, who are unaccustomed to wearing spectacles, will have difficulty of one sort or another with their planos. While this group is small in number, it is, nevertheless, important. These workers must be made comfortable and the number of employees who consistently complain about any safety device are a threat to the compliance of the entire plant.

People with plano problems fall into three main categories: (1) The totally uncooperative individuals who resent wearing safety glasses, safety shoes, safety hats, etc. Once it is established that there are no refractive errors and that the plano frames fit properly they become problems for the safety inspectors. These cases are rare, once a safety program becomes established. (2) Those who believe they have developed visual difficulties as a result of wearing planos. A typical example is the man who started to wear planos at age thirty-eight or forty and feels that his presbyopia is the direct result of his having worn safety glasses. A patient explanation of the development of his problem usually suffices. This must be done for the comments of a few employees, who insist that planos have actually damaged their eyes, would wreck employe morale in regard to the eye protection program. (3) The third and largest group consists of employees who experience eye strain or blur associated with wearing planos. People in this group make comments such as: "Every time I wear planos I get a headache"; "Safety glasses blur me"; or "Planos pull my left eye." There is an element of resentment that usually develops in this group, too, but an effort to solve the patient's difficulties usually eliminates this feeling of resentment.

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†Industrial Optometrist.

SUBJECTS

This report consists of a study of twenty-six employees of the Norfolk Naval Shipyard who are in the third category. See Table 1.

No.	*Position*	*Age*	*Complaint*	*Disposition*
1.	Helper	40	Blur	Adjustment
2.	Helper	36	Headaches	O. U. +.62
3.	Mechanic	34	Asthenopia	R. +0.25 — 0.50 × 15. L. +0.25 —0.50 × 5
4.	Mechanic	29	Asthenopia	R. —0.25 — 0.50 × 180. L. —0.50
5.	Mechanic	45	Blur	O. U. Plano. Add +1.00
6.	Mechanic	45	Asthenopia	R. —0.75. L. —1.00 Add +1.00
7.	Laborer	33	Asthenopia	Adjustment
8.	Mechanic	34	Headaches	R. +0.25 —0.25 × 75. L. +0.50 —0.25 × 130
9.	Mechanic	33	Asthenopia	Referred for conjunctivitis
10.	Supervisor	41	Asthenopia	O. U. +0.62
11.	Mechanic	40	Asthenopia	Adjustment
12.	Mechanic	41	Headaches	Adjustment
13.	Mechanic	31	Asthenopia	O. U. +0.62. #1 tint
14.	Mechanic	44	Asthenopia	R. —0.62 × 135. L. —0.25
15.	Mechanic	44	Blur	Adjustment
16.	Helper	30	Blur	Adjustment
17.	Helper	39	Headaches	Adjustment
18.	Mechanic	30	Asthenopia	Adjustment
19.	Professional	38	Asthenopia	O. U. +0.87
20.	Professional	31	Headaches	R. +0.50 — 0.50 × 100. L. +0.25 — 0.75 × 80
21.	Laborer	25	Asthenopia	R. —0.25 —1.00 × 85. L. —0.25 × 90
22.	Laborer	31	Asthenopia	R. +0.75 —0.50 × 180. L. +0.50
23.	Mechanic	51	Blur	O.U. — 0.37 Add + 1.50
24.	Mechanic	41	Asthenopia	Adjustment
25.	Mechanic	33	Asthenopia	R. +0.50. L. +0.37
26.	Mechanic	39	Asthenopia	O. U. + 1.00

Twenty-nine people, of the approximately 3,900 wearing planos, complained about their safety glasses between the dates February 10 and July 1, 1957. Three of these were ill or on extended leave so that the evaluation of their cases could not be completed.

Ten of the twenty-six subjects were referred from the screening program. Every two years all employees, who work in eye hazardous areas, are screened on an American Optical Company sight screener. At this time, as a part of the screening process, each employee is asked, "Do you have any difficulties with your eyes?" and if the answer is yes, "What kind of difficulties?" Those who reported having difficulties with their planos were set up for this evaluation.

A second source of subjects was the Industrial Optometry Office. Most employees, who are concerned about their eyes or their safety glasses, will request a dispensary slip to the Industrial Optometry Department. Those employees who fail to do this but complain about their eyes to their fellow employees will be sent in by their supervisors.

When the complaint concerned the wearing of plano safety glasses the employee was referred for this report. This source produced sixteen subjects.

While these twenty-six individuals are not adequate for a reliable statistical study of this problem, we can see certain trends developing, and we can make certain general statements.

The ages appear to be evenly distributed from the mid-twenties to the mid-forties. Of course, we can assume that anyone beyond this age would have become sufficiently presbyopic so that he would have had to be wearing a prescription lens. There was one exception, case number 23, a fifty-one year old machinist who announced that he could not read while wearing planos, although he could read for two hours at home without his safety glasses. He is now wearing O. U. —0.37 D. sph. with a +1.50 D. spherical addition, and reports that he is doing well. The greatest number of subjects were mechanics. There were sixteen shipfitters, machinists, joiners, etc. This is understandable since the helpers (five) and the laborers (two) have fewer demands made on their eyes and the supervisors (one) are more likely to fall into the presbyopic age group as well as being somewhat fewer in number. The professional group, i.e., engineers, etc., are represented by two naval architects. This low number may be explained by the fact that these people are less frequently in eye hazardous areas and as a result, wear their planos less frequently.

HISTORY

A careful history was taken of each complaint, first, to establish the exact nature and extent of the difficulties; second, to establish that the principal complaint was completely associated with wearing planos and not just a part of a larger picture.

On occasion it was hard to believe that such severe symptoms could result from wearing any sort of industrial eye protection. It was sometimes established that there was a definite ocular problem. Still, the symptoms were completely associated with wearing planos.

An example is case number 6. This forty-five year old patient's main and only complaint was, "Safety glasses make my left eye pull." Considering his age, he was asked if he did not have trouble reading. He emphatically denied this. Then, considering the possibility of his being myopic he was asked if he did not have trouble seeing distant objects. Again, there was an emphatic denial with a statement that his only trouble was, "Safety glasses make my left eye pull." This patient is now wearing the following correction: O. D. —0.75 D. sph.

O. S. —1.00 D. sph. with O. U. +1.00 D. sph. addition. And, he was asymptomatic at the follow-up consultation.

Sixteen of the complaints were varied expressions of eye strain and five employees said that their planos gave them headaches. There were five complaints about planos causing a blur. Two of these were near point complaints and both of these employees are now wearing bifocals.

In the cases of the three complaints of blurring generally, there was no significant error and all are now getting along well since their planos have been carefully fitted to them.

REFRACTION—ADJUSTMENT

The procedure followed in these cases was meant to be worked in with the regular operation of the Industrial Optometry Office. However, three cases did not follow the normal procedure in that they had their planos adjusted and then at a later date were called in for refractions.

The procedure followed in the rest of the cases is as follows: Each subject was refracted. If there was no appreciable refractive error or muscle imbalance the plano frame was adjusted as carefully as possible. In cases where minor refractive errors were found and it was ascertained that the adjustment of the plano frame was not far off, the corrective lenses were prescribed. Of course, major refractive errors were corrected.

While this is not a report on the efficacy of minor corrections a number of employees who were experiencing difficulties with planos are now asymptomatic with low powers.

A case in point is number 8. This thirty-four year old pipefitter said, "Planos give me headaches." These proved to be frontal headaches that developed as the day progresses. He obtained relief by surreptitiously removing his planos at every opportunity. The following lenses were prescribed: O. D. +0.25 D. cyl. axis 15. O. S. +0.25 D. sph. $\bigcirc$ +0.25 D. cyl. axis 40. The patient stated at the follow-up examination that he was now able to wear his safety glasses without discomfort. While the psychological aspect of the new safety glasses must have played a part in having an employee content with his safety glasses this at least was achieved.

In alleviating the twenty-six problems, sixteen received prescription safety glasses, nine had their planos re-adjusted or new ones fitted and one employee was referred for treatment of his conjunctivitis.

The adjustment problems frequently consisted of badly bent frames and badly scratched lenses. However, case number 12, a forty-one year old chauffeur, admitted at the follow-up consultation that he had complained about his planos because he wanted to switch from metal to plastic frames.

The types of refractive errors which produced symptoms only when planos were worn fall into three groups. There were seven cases of low astigmatic errors in one or both eyes. The strongest correction in this group was O. D. —0.25 D. sph. ⊂ —1.00 D. cyl. axis 85. O. S. —0.25 D. cyl. axis 90.

The second largest group consists of six people now wearing plus spheres. The lowest correction O. D. +0.50 D. sphere, O. S. +0.37 D. sphere, went to case number 25, a thirty-three year old electronics mechanic whose eyes burned and watered when he traced circuits. The strongest correction, O. U. +1.00 D. sphere, went to a thirty-nine year old pipe coverer and insulator. He had been treated by a local oculist for conjunctivitis for some time and told that he did not need glasses. He apparently associated the symptoms of conjunctivitis with his wearing planos rather than with the close work he did. At any rate he is now asymptomatic with his correction and his conjunctivitis is cleared up.

The three remaining employees received bifocals. Two with low minus corrections and one with plano at distance.

FOLLOW-UPS

Depending upon the other demands of the Industrial Optometry Program, the subjects received a follow-up consultation from two to five weeks after receiving their prescription lenses or having their planos adjusted. It was intended that any unresolved complaints would be reinvestigated and the entire process would be repeated. However, with one exception, in each case the employee reported that he was able to wear his safety glasses during the work day with reasonable comfort.

The one exception was case number 22, a thirty-one year old laborer who came into the Industrial Optometry Office complaining that planos made his eyes ache. He happened to be one of the three, mentioned above, who did not follow the normal procedure. Since his safety glasses were out of adjustment an optometric aide adjusted his glasses and told him to return if he had further trouble. He was called back and reported that he was still having nearly as much trouble. His refractive error proved to be O. D. +0.75 D. sph. ⊂ —0.50 D. cyl. axis 180. O. S. +0.50 D. sph. He is now doing well with these lenses.

SUMMARY

Industrial employees who must wear plano safety glasses sometimes experience discomfort or blur. Their problems are particularly important since this affects their work and even a small number of persons complaining about safety glasses will interfere with the administration of an eye safety program.

A study was made of a group of twenty-six employees of the Norfolk Naval Shipyard who had complained of their planos. Sixteen of these people were found to need prescription spectacles. And, with these they have all reported comfort.

Each of the above employees had been asymptomatic on week-ends and on leave when they had not worn their planos. Apparently there was something about their planos which called attention to the wearers' eyes. Because, while the symptoms caused by their minor refractive errors went unnoticed normally, while wearing their planos they were aware of them.

The prescriptions fell into three main types: low astigmatism, plus spheres, and three pairs of bifocals.

With the exception of one employee, referred for conjunctivitis, it was sufficient to adjust or replace the safety glasses of the others. All of these employes now report comfort.

REFERENCES

1. Hofstetter, H. W. "Industrial Vision." Chilton, Philadelphia, 1956.
2. Kuhn, H. S. "Eyes and Industry." Mosby, St. Louis, 1950.

ANNOUNCEMENT

NATIONAL BOARD OF EXAMINERS IN OPTOMETRY

The National Board of Examiners in Optometry met at the Drake Hotel, Chicago, December 10-11 for their annual organizational meeting. The officers and members of the Board are: Dr. Harold M. Fisher, New York City, president; Dr. Jack Rust, Topeka, Kansas, vice-president; Dr. John R. Uglum, Reno, Nevada, secretary-treasurer; Dr. Newton Lenz, Waupun, Wisconsin; Dr. Darrell B. Carter, Houston; Dr. Foster Namias, Boston, and Dr. Rudolph Ehrenberg, Granite Falls, Minnesota. The Spring 1958 examinations will be given at all schools and colleges and applicants may write the Secretary, Dr. Uglum, Robinson Building, Reno, for time and schedules.

A COMPARISON OF CORNEAL AND SCLERAL TONOMETRY*

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The subject of glaucoma, what causes it, and how to diagnose it effectively is indeed a complicated and interesting problem which deserves our attention for the benefit of our patients. The increase of the intraocular pressure has been given as the cause of glaucoma—with the exception of the low tension glaucomas. This paper is written to encourage the use of the scleral tonometer in the detection of the rise in intraocular pressure. It is my belief that it will aid optometrists in securing information about glaucomatous patients and enable them to detect it in its early stages.

Hirsch[1] advanced several possible experiments which might be done. He suggests that it could be checked against the corneal tonometer and states that "absolute corneal values must be considered with great care, however, it is the repeated use of the corneal tonometer that gives it its greatest value." With this fact in mind, I have compared the two tonometers realizing that scleral values should be considered with the same care. Another check that could be done would be to use the scleral tonometer on a known group of glaucomatous eyes and upon another group of non-glaucomatous eyes. In the last part of this article the glaucomatous eyes found were compared as simply as possible, using the corneal tonometer as the means of determining them for glaucoma since these eyes had shown repeated high tensions by that means.

The reliabilty of the instrument has been set forth by Hirsch, and he presents the hypothesis that the validity is compatible with his results. I hope, with this article, to show that the use of the scleral tonometer is warranted in the office of optometrists.

PROCEDURE

A Wolff tonometer was used to record the scleral readings, and the procedure followed was that recommended by the manufacturer, and all readings were taken in the upper-outer quadrant as this proved to be the most accessible and gave the most accurate results for my purpose.

*Submited on September 27, 1957, for publication in the January, 1958, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.
†Optometrist.

The corneal tonometer was a recent model Schiotz and was checked before use to be certain that it would be correct. A 7.5 gram weight was used for all readings with the corneal tonometer and a solution of 0.5% dorsacaine topical anesthetic placed in the eye after the scleral readings had been recorded. Approximately fifty patients were checked prior to recording any data to familiarize myself with the scleral tonometer and decide where I would obtain the readings with the scleral tonometer.

EXPERIMENT NO. 1

A total of fifty-one patients were included in this group, and the information obtained was the age, sex, refractive status, pathological findings and the intraocular tension by the scleral and corneal tonometers. In this experiment all patients were reclining when the tensions were taken, and all tensions were taken in the morning.

The tension was taken twice with the scleral tonometer after the first reading had been discarded, and if close, the readings were averaged. If a wide separation was present, a third reading was taken, and the two closest were averaged and used as the scleral tension. The corneal values were taken twice, and the readings averaged and used for the corneal tension.

In this portion of the experiment thirty-three subjects were above the age of forty, the remaining eighteen were under forty, twelve being under thirty. The refractive status ranged from high myopia (—8.00) to aphakia (+14.00). The pathological findings were those of an ophthalmologist and included almost anything which might be found in a normal population with the exception that perhaps more pathology was present than in a random sampling.

Table I shows the differences between the corneal and scleral readings on the same eye and are recorded as a group, regardless of whether the corneal or scleral readings were higher.

TABLE I

Difference	0	1	2	3	4	5
Number showing difference	29	41	22	4	1	3

Table II shows the difference of the corneal and scleral tonometers on both eyes of the same individual, i.e., tension O. D. corneal vs. tension O. S. corneal.

TABLE II

Difference	0	1	2	3	4	5	6	7	8	9	10
Corneal	12	6	9	13	4	1	2	2			
Scleral	6	15	12	5	5	1	2	2			1

Sugar[2] states that according to H. K. Müller[3] the probable error with a 5.5 gram or a 7.5 gram weight is ±5 mm., when variation in ocular rigidity is considered. If the same probable error were given or found for scleral tonometry, we might assume that scleral tonometry is almost as selective as corneal tonometry. All four of those with the corneal tonometer above five millimeters HG were under treatment for glaucoma, of the five with the scleral tonometer four were under treatment for glaucoma and the fifth showed only a corneal difference of three and had no fundus changes.

Table I shows that the differences of the corneal and scleral tonometers are fairly close and this was verified when the coefficient of correlation was taken. Table II shows that it is almost as sensitive to changes in the intraocular pressure of the eye as the corneal tonometer.

The mean for the scleral tonometer in both eyes was 20.7 and was 21.1 for the corneal tonometer for this sample of 100 eyes. The standard deviation was ±3.6 for the scleral readings and ±4.0 for the corneal readings. The range for the scleral was from 12 to 30, for the corneal it was 14 to 32. These values for the corneal tonometer compare favorably with those of many authors in a table in Duke-Elder.[3] Assuming two standard deviations on either side of the mean as normal limits, the middle 95% would lie between 13 to 28 for the scleral tonometer and 13 to 29 for the corneal tonometer. The theoretical and the actual values can be seen to lie in close approximation, and the averages of the corneal readings are close to those found by others doing tonometry.

The coefficient of correlation between the corneal and scleral values was +.84 which must be considered very good since the sclera is more rigid and the tendency for the curvature to vary is greater.

When the data is plotted for both the corneal and scleral tensions, the scleral shows a slight bimodal effect from 23 to 26 which is somewhat lower and not as long as that found by Hirsch.[1] The frequency distribution is presented in Table III.

EXPERIMENT NO. 2

Since the values taken in the first experiment were good, a second set was taken where another person did the corneal and I did the scleral, the values were then brought together later. Here the corneal tonometer readings were done in the same manner as before, but the scleral readings were taken with the patient in a sitting position. A total of twenty-three patients and forty-six eyes were in this sample, and the same data were taken here as previously.

TABLE III

	Scleral	Corneal
12	1	0
13	3	0
14	2	4
15	1	1
16	0	1
17	2	6
18	18	14
19	17	8
20	11	15
21	6	12
22	11	5
23	2	10
25	11	7
26	4	1
27	6	8
28	1	2
29	3	4
30	0	1
31	1	0
32	0	1

The values retained their good correlation in this part even with the differences mentioned above. The mean for the scleral was 20.9 and for the corneal it was 21. The standard deviations were ±4.4 for the scleral and ±4.2 for the corneal. The coefficient of correlation was a +.85 which is good. The range for the scleral was 15 to 32 and for the corneal was 15 to 30 which was much the same as in the first set of data. Two standard deviations here would give 12 to 27 for the scleral and 13 to 29 for the corneal.

Since the values for the two groups were close they were placed together, and the glaucomatous separated from the non-glaucomatous for the next part of the study.

In this section all corneal tensions above 26 were considered as glaucomatous since many of the patients had shown repeated high tensions with the corneal tonometer. All values above 25 with the scleral tonometer were considered as being glaucomatous, and here we must realize that most previous authors have stated that we cannot assume a definite cut-off point for the scleral tonometer, however, the writer feels that this was the only way he could compare the two findings on glaucomatous eyes. Table IV shows how the values of these patients compared.

This table shows seventeen eyes in which both the corneal and scleral tonometers gave agreement and glaucoma was present, seven in which the scleral reading was lower than the glaucoma point chosen. In this second group the writer would like to mention several points

TABLE IV

Corneal greater than 26	17
Scleral greater than 25	17
Corneal greater than 26	7
Scleral less than 25	7
Corneal less than 26	8
Scleral greater than 25	8

that he believes may be important. First, that in two of these seven eyes the palpebral aperatures were small, and it was difficult to obtain the scleral tensions. Secondly, the fixation was poor in many of the individuals, and this makes it difficult to obtain scleral tensions since there is always the possibility of injury if the patient should happen to move his eye. Two additional cases in the seven had severe cupping of the disc, and this would have been seen during the fundus examination.

This then leaves eight cases in which over referral would be possible and this would be low when one considers that there are 146 eyes in the study. Of these eight, two were under treatment for glaucoma and the scleral rigidity may have been changed sufficiently to make the difference. Considering the eight cases without any reductions the percentage of over referral is 4.6% and I believe that this could be further reduced with the use of visual field studies on these patients.

The total percentage of the cases missed by the scleral tonometer using the corneal as the basis for glaucoma would be the ones where the scleral tonometer showed tensions either too high or too low and would be 10.3% of the total.

SUMMARY

(1) The scleral tonometer seems to be an accurate measure of the intraocular pressure when compared with corneal tonometry.

(2) Assuming the same reservations for the scleral tonometer as for the corneal tonometer, it should be a useful instrument to detect glaucoma in the optometrist's office. It is not an infallible instrument, and other tests should be performed to insure your diagnosis.

(3) In using scleral tonometry all tensions over 25 should be regarded with suspicion and future study made of the patient.

(4) It seems to make no difference whether the patient is sitting or reclining.

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(References on next page.)

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BOOK REVIEW

CONTACT LENSES. Theo E. Obrig and Phillip L. Salvatori. Published by the Obrig Laboratories, Inc., 49 East 51st St., New York City. 780 pages. 197 illustrations. Cloth. $15. 1957.

This is a very well written comprehensive treatise on Scleral Contact Lenses, their history, development, technique of molding, fitting and alteration. Every step in these procedures is described in great detail and the book is well illustrated. In addition, there are chapters on the plastics used in fabricating contact lenses and the optics, anatomy, physiology and biochemistry of the parts of the eye involved in fitting contact lenses.

The authors, who have had vast experience in the fitting and manufacture of contact lenses, make many valuable suggestions in the actual practice of fitting the lenses and describe the instruments and equipment that is necessary to do this work properly. They include tables and scales that simplify many of the optical calculations.

Unfortunately, there is a great deal of emphasis in favor of scleral lenses, and the book may well have been given the title, "Scleral Contact Lenses." In the reviewers opinion the authors have failed to give adequate attention to corneal lenses, which, at the present time, seem to constitute the majority of contact lenses fitted today. In fact, nearly as much space has been devoted to the nearly outmoded fluid lenses as has been devoted to corneals.

Nevertheless, there is very much to recommend this text. The bibliography is most complete, as is the inclusion, in detail, of the patents on contact lenses from 1903-1953. All together, it is a most valuable addition to an optometrists' library.

BERNARD MAZOW, O.D.

4118 FANNIN
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USE OF TURVILLE SUBJECTIVE TECHNIQUE IN CASE OF ANISOMETROPIA AND PSEUDO-AMBLYOPIA. A CASE REPORT*

Thomas F. Brungardt†
Salina, Kansas

History: Age, 22: female. Physical condition, normal. Patient's chief complaint, a tired feeling when watching television and in reading. The patient complained of getting dizzy occasionally. Prior Rx., none.

External Examination: Pupillary reflexes: direct, consensual accommodative: normal. Tension, tactile: normal. Versions, binocular: normal. Lids, conjunctiva, iris, anterior chamber: normal

Fundus Examination: Ophthalmoscopy: normal.

Refractive Examination:

Static Skiametry: R. +1.50 —0.50 × 180
L. +4.75 —1.25 × 165

Red-green Monocular: R. +0.25
L. +3.25

Maximum visual acuity (monocular testing):
R. +0.25 20/20
L. +3.00 —1.25 × 155 20/60

Naked Acuity: R. 20/20. L. 20/60-1. The acuity in the left eye was improved to 20/40-2 by presenting one letter at a time to the patient, thus simulating the acuity found in amblyopes.

Turville Test: R. +0.25 20/20
L. +4.00 —1.25 × 155 20/25

Throughout the Turville test the patient was instructed to keep her attention directed to the right hand side. A control over the accomodation was thus provided and allowed a full +1.00 D. to be added to the left eye with a resultant increase in the visual acuity. Phoria: 6 M. (right eye target control): 1 esophoria. Phoria: 40 cm. (right eye target control): 4 exophoria

Monocular cross cylinder: R. + 1.00
L. + 5.25 —1.25 × 155

Vergencies: Negative 16-24-16
Positive 12-24-8

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†Optometrist. Fellow, American Academy of Optometry.

Analysis: The prescription given was as found in the Turville subjective test. The visual acuity taken while the Turville septum was in place differed from a monocular visual acuity. While the patient was reading the 20/25 line with the left eye, the right eye was covered and the patient reported a blur of the left image. She could only read the 20/60 line monocularly. Care was taken in aligning the septum so that the right eye did not see any letters or parts of letters on the left. This was done by occluding the left eye and moving the septum until the left eyed images were completely blocked off from vision.

The patient demonstrated no suppression area, nor could one be found with the telebinocular. The patient's response to a binocular situation is the reverse of that expected in a suppression case. The explanation is that the left eye monocularly over accomodated with the correction in place with a resultant blur; but under binocular conditions the right eye set the pace for accommodation and allowed a reasonable acuity with the left eye. The explanation is further supported by the over amount of plus found on static skiametry for the right eye. The left eye was fixing the target through at least 4.50 D. blur.

Visual training was advised and the patient told to wear the correction constantly. The patient agreed to the lenses but could not attend the visual training sessions. She was to report back in one month.

The patient did not return in one month but telephoned that she wore her lenses constantly and did not experience any difficulty. She had experienced some nausea and discomfort when she first began to wear the lenses but not enough to be alarmed.

CONCLUSION

The interest in this case lies in the value of the Turville subjective test. If this test had not been used one would have assumed an amblyopia. A patching routine or right eye partial occlusion might have been suggested to the great discomfort of the patient. The Turville test eliminated the need for such advice. In addition the correction decided upon without the Turville test would have been probably the least plus found or at least one diopter less than finally prescribed.

SUMMARY

The patient was given her first correction, a maximum of 3.00 D. difference between the lenses, and experienced no great difficulty. The testing routine which was used eliminated a pseudo-amblyopia elicited by normal testing

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OBSERVATIONS ON OPTOMETRY'S AND OPHTHALMOLOGY'S INTERPROFESSIONAL RELATIONS

Recent events in interprofessional relations between optometry and ophthalmology have prompted questions and predictions concerning the likely future of the two groups. On a very pessimistic note, some question if optometry as a professional group will continue to exist. On the less pessimistic side, many question what will be the relative roles in the eyecare field of the two groups in the future. Needless to say, the future in this regard cannot be foretold with any great certainty, no more than human events generally can be forecast. In discussion pertaining to the future, it is characteristic of mankind to allow his emotions to blind him to many of the facts. Consequently, there are the soothsayers forecasting the extremes of doom and the pot of gold at the end of the rainbow.

It is all well and good that individuals in optometry and ophthal-

mology have their concepts of what is best for the public in the manner of future eyecare. It is to be expected that some individuals in each group will actively work in the hope of bringing about change to advance the concept which they hold. It's unfortunate when the active work of some ignores observation of ethical principles. But through any means, fair or foul, individuals can only influence the future course of human events within the limits imposed by conditions beyond their complete control.

Those who either hope or fear that optometry will vanish in the future would do well to consider several existing factors which either cannot be controlled or are so difficult to control as to make the influence of individuals or groups within optometry or ophthalmology very ineffective. First and foremost, there is the fact that the volume of medical and surgical eyecare, particularly surgical, is small in comparison to the volume of non-medical and non-surgical eyecare. Enough medically trained personnel to fill the need for all refractive and other non-medical eyecare would thin out the medical and surgical work among so many that none, or few, would be experts in medical and surgical eyecare. Ophthalmology becomes unattractive as a specialty to the physician when it becomes necessary for him to substitute almost entirely non-medical practice for the medical and surgical eyework he would like to do. Another fact, which must be reckoned. It has not been possible to control the supply of physicians to keep it in pace with the demand for all kinds of medical services, especially with the expanding population. According to the most reliable sources, the number of physicians licensed this year will fall short by 2,700 of the number required to maintain the present doctor-patient ratio. The outlook for the future promises an increasingly more critical situation in physician supply. From whence come the physicians to specialize in ophthalmology?

Regardless of aims, motives and actions of individuals or groups, the public will seek the best and most convenient eyecare it can get. It would seem unlikely, if not impossible, that either of the two professional groups in the field of eyecare can radically change the existing "balance of power." The factors which are impossible or so difficult of change should be recognized by all concerned. Then, in view of the inevitable existence of the two groups for an indefinite time, the important question becomes, "are the present actions of the two groups and their component parts in the best interest of public welfare?" If, indeed, we are professional people who place the welfare of the public above all and any other considerations as we profess to do, this question needs careful re-examination.

Medicine must answer for medicine, and optometry for optometry. Each of the professions has individuals and groups within their ranks whose actions seem to fail to give first consideration to the welfare of the public. Both professions suffer from such actions. Let medicine discover and do what it will about its mistakes in interprofessional relations. At the same time, optometry has responsibility for actions of its members and its organizations. Let all actions, either of individuals or organizations, give top consideration to the welfare of the public and progress of all is assured.

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TRANSACTIONS OF THE AMERICAN ACADEMY OF OPTOMETRY

A department devoted to announcements, reports, appointments, organization data, news, professional problems and ideals, as these relate to the Academy.

THE ANNUAL REPORT OF THE PRESIDENT*

Robert W. Tubesing†
Richmond, Indiana

It is my privilege to welcome each of you to the 37th annual meeting of the American Academy of Optometry. The members of the executive council and all who have a part in these meetings join me in expressing our pleasure in having you with us and participating in these proceedings.

In January of this year, the executive council of the American Association for the Advancement of Science granted the Academy affiliate membership in its organization. The Academy had been an associate member around 10 years. Dr. Henry Hofstetter was appointed the first Academy representative on the council of the A.A.A.S. under this new affiliation. Academy Fellows are urged to become members of this excellent scientific organization and to participate in its program whenever possible.

*Read before the annual meeting of the American Academy of Optometry, Chicago, Illinois, December 7, 1957. For publication in the January, 1958, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

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In June, after the application of the Academy to membership in the International Optical League was accepted, the Academy was elected "on the spot" to the executive council of the League according to Mr. Eric Bateman, Secretary of our British Chapter who was representing the Academy at its meeting in Amsterdam. Mr. Bateman has graciously accepted the present responsibility of representing the Academy on the council of the League at its next Annual Meeting.

Also in June, the Academy was given the opportunity to have exhibits at the Optical Fair in Chicago and the American Optometric Association Convention in Los Angeles. The booth at the Optical Fair, as well as the furniture and signs used, was offered through the gracious efforts of Mr. Charles Oddy and the Optical Manufacturers Association. Dr. Alfred Rosenbloom and Dr. Grace Stevesson, with the help of the Illinois chapter and staff of the Illinois College of Optometry, planned and manned the booth. The booth at the A.O.A. Convention was planned jointly by Dr. Arthur Hoare and Dr. Charles Abel and manned by members of the Los Angeles Chapter and the staff of the Los Angeles College of Optometry. This activity brought Academy activities to the attention of a large number of optometrists and resulted in several applications for Academy Fellowship.

An Academy luncheon was held during A.O.A. convention with about 100 Fellows in attendance. The arrangements for the luncheon were planned by Dr. Harry A. Jankiewicz and the Los Angeles Chapter. Dr. Carel C. Koch and your president spoke briefly on Academy affairs. The Los Angeles Chapter presented an honorary award to Dr. Arthur Hoare for outstanding service to the chapter throughout the years. The luncheon was thoroughly enjoyed by all in attendance.

During the banquet at the A.O.A. congress, Los Angeles, Dr. Ernest Kiekenapp was honored for 35 years of continuous and unselfish service to optometry as Secretary of the A.O.A. and later editor of the JOURNAL OF THE AMERICAN OPTOMETRIC ASSOCIATION. Dr. Carel C. Koch and his A.O.A. committee planned and arranged this tribute to Dr. Kiekenapp. A letter of appreciation from your president was included in Dr. Kiekenapp's *"Memory Book of Letters"* expressing the appreciation of the Fellows of the Academy for his many years of untiring service.

In October the *"Sheard Volume—Visual and Ophthalmic Optics"* was published. This fine book, published as a tribute to Dr. Charles Sheard, is also a testimonial to the cooperation of the committees of ophthalmologists, opticians and optometrists who sponsored its publication. I should like to quote from a letter written by Dr. Sheard on

November 11, 1957. "I am doubtful whether I shall be able to be present at the Chicago meeting of the Academy. If I am not there in person, I shall be with you in spirit and, through you as president, would wish to send my most cordial greetings to all the members and my expression of appreciation of all the fine work the Academy has done and is doing.————In closing this letter, let me again express the great pleasure and the rejoicing that I have because the volume that contains some of my writings has become a reality and that it is so excellent in its appearance and we hope also in its contents."

The affairs of the Academy have been handled most effectively throughout the year. The team of Academy officers from the members of the executive council to the members of the various committees has functioned perfectly and constantly.

We have just completed the third and most successful of the annual Post-Graduate Courses. Drs. V. J. Ellerbrock and D. G. Hummel, with their committees, have done an outstanding job in arranging and presenting these courses. The section meetings have been planned this year under the general chairmanship of Dr. Donald Springer and the section chairmen. The papers program has been planned by Dr. Ralph Wick and his committee on papers. You will hear shortly from Drs. Springer and Wick who will outline their extensive and well balanced program for these four days.

The primary purpose of the Academy—to offer a forum for the presentation of ideas and development of the science of optics and optometry—has been met this year. Fifty-nine papers have been presented in the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY in the 10 monthly issues from January to October, inclusive, this year. Forty-nine Post Graduate Courses have now been presented. Sixty-four papers will be presented on the General Program and Section Meetings during this and the next three days. The topics of these 172 papers are divided into the following subjects:

Refraction	16.0%	
Pathology	11.0%	16.0%
Interprofessional Relations	5.0%	
Physiological Optics	14.8%	
Orthoptics	10.8%	
Reading	4.6%	
Sub-Normal Vision	4.6%	
Vision	4.6%	
Contact Lenses	4.0%	
Aniseikonia	4.0%	
Designing and Dispensing	4.0%	
Economics	3.4%	
Visual Screening	3.4%	

Optics	3.4%
Miscellaneous	3.4%
Occupational Optometry	3.0%

It is interesting to note the various subjects which have been included in this list. There is one unique situation in that the same number of papers have been presented on refraction as have been presented on pathology and interprofessional relations. Dr. Jay Enoch, chairman of the Section on Pathology, in a letter written April 22, 1957, pointed out "The Pathology Section occupies a somewhat unique place within the organization of the Academy. This uniqueness is imparted by the fact that the treatment of pathological conditions falls outside the domain of optometry." The interest of the Academy Fellows as expressed in the number of papers presented on pathology and interprofessional relations while at the same time affirming that the treatment of pathology lies outside the realm of optometry can mean only that the great importance of recognizing signs and symptoms of ocular or systemic diseases and referring promptly those patients exhibiting these signs or symptoms for proper treatment is fully recognized by Academy Fellows in the interest of preventing blindness. We all recognize that only a small percentage of patients consulting optometrists exhibit these signs and symptoms of disease.

The optometric educators and scientists who have written and presented a number of these papers are also preparing optometrists to fulfill their responsibilities to society. Since most of these educators and scientists are now actively teaching undergraduate professional students in optometry, it may be assumed that the undergraduate courses will include these subjects in addition to the basic or background courses in optometry taught undergraduates.

Now anyone may subscribe to the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY. All optometrists who are members of the American Optometric Association may register for and attend our annual Post Graduate Courses. All members of the American Optometric Association who will qualify themselves for Academy Fellowship may join the Academy and participate in the many programs presented at the annual meetings and in the Chapters.

The optometric educators and scientists who have presented these papers and will continue presenting papers are challenging all optometrists, who are sincerely interested in seeing that their patients receive the best eye care available today, to avail themselves of the knowledge and techniques presented through the Academy and to apply that knowledge and those techniques in their own practices.

Dr. John Davey used to delight in recalling a remark made by Dr. Herman B. Wells, President of Indiana University, about ten years ago. Dr. Wells' statement went something like this: "Optometry is that profession dedicated to the developing, protecting, and preserving man's priceless possession—Vision." Optometrists who incorporate in their practices the ideas and techniques presented by our optometric educators and scientists at the Academy meetings and in the *Academy Journal* are truly dedicated men of vision.

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RICHMOND, INDIANA

ACADEMY MEETS IN CHICAGO

The scene is Chicago. The great metropolis of the upper mid-west. Chicago at its best with the sharp tang of early winter and Christmas just ahead. Optometrists are everywhere. Academy men at the Drake and the Illinois Optometric Association at the Morrison. The two groups merge on three occasions during the week-long convention period. More than a hundred persons appear on educational programs. Each speaker a star performer, upper case, in what will live for years as a spectacular gathering of optometric educational luminaries.

At the Drake, Dr. E. LeRoy Ryer, New York City, was honored by being elected a Life Member of the American Academy of Optometry. Dr. Ryer is the eighth member to whom such presentation has been made during the past 36 years.* Dr. Ryer was selected for this honor because of his many contributions to clinical optometry and because of the impact his own practice has had on the general practice standards of optometrists throughout the U.S.A. and Canada. During his years of practice his contributions to the profession have been so outstanding that the Academy was proud to honor him at this convention. It was with regret that it was learned that conditions made it impossible for him to come to the meeting.

Dr. Ryer, throughout his entire professional career, has been a great leader directing the forces of optometry toward high practice standards and full professional responsibilities. For 50 years his own standards as an educator and optometrist in practice have been tops. His office in New York City has served as a model for hundreds of offices throughout the country. In his practice, as well as in his contacts

*Others are: Dr. Frederick A. Woll, Dr. Alpheus W. Smith, Dr. James P. C. Southall, Dr. Julius Neumueller, Dr. William L. Benedict, Dr. Charles Sheard and Dr. Albert Fitch.

with optometrists. Dr. Ryer is an artist. He is a tremendously gifted man, warm-hearted, sensitive and rebelious against mediocrity. At times he seems to be an enemy of convention, yet his years of outstanding practice have brought into optometry his high conventional standards that are accepted throughout America as the proper method of conducting an optometric practice.

Coupled with one of the finest practices, Dr. Ryer also served his profession as a faculty member of one of the early independent optometric colleges. He was editor of ARCHIVES OF OPTOMETRY and professional consultant to several instrument makers. A self illuminated test chart and cabinet designed by him was widely used by optometrists everywhere before the idea of projecting test types became popular. The present day ophthalmometer, too, owes much of its accuracy to his technical suggestions. Dr. Ryer was one of the founders of the Academy and has been a loyal supporter of all that it has stood for over the years.

His book on *Ophthalmometry* is still the final authority dealing with this technique and his many, always welcome, contributions to the literature will live on with the profession.

For a number of years Dr. Ryer was associated in practice with Dr. Elmer E. Hotaling. The names Ryer & Hotaling associated with an idea, or a suggestion, were synonymous with *sterling* or *24K* as a standard of value, and their joint contributions to clinical practice, as well as practice building techniques, were accepted widely. Following the untimely death of Dr. Hotaling, an Academy past-president, Dr. Harold M. Fisher has become an associate of Dr. Ryer, taking, in stride, the place of Dr. Hotaling. Drs. Ryer and Fisher have recently opened their new offices at 80 Park Avenue, New York City. Dr. R. L. Ryer, a son, is in optometric practice in Lakeland, Florida. "At this time," said President Tubesing, "Academy members throughout the world congratulate Dr. E. LeRoy Ryer upon his election as an Honorary Life Member."†

The award was made during the banquet by President Tubesing and was accepted for Dr. Ryer by Dr. Fisher. Those at the speakers' table were: Dr. Robert W. Tubesing, president, American Academy of Optometry; Dr. Lester H. Sugarman, president, American Optometric Association; Dr. Henry W. Hofstetter, director, Division of Optometry, Indiana University; Dr. Lawrence Fitch, dean, Pennsylvania State College of Optometry and vice-president of the Academy; Dr. E. B. Alexander, president, Optometric Extension Program Foundation;

†See Frontispiece, page 2.

Dr. Eugene W. Strawn, president, Illinois College of Optometry; Dr. William Greenspon, chairman, Council on Education, American Optometric Association; Dr. Harold M. Fisher, president, National Board of Examiners in Optometry; Dr. Ralph Barton, president, Illinois Optometric Association and Dr. Harold Simmerman, a past-president of the Academy, and chairman of the Academy Committee on Admittance.

The two addresses of the evening were presented by Doctors Sugarman and Hofstetter. Dr. Sugarman reviewed the plans of the American Optometric Association and the desire of optometry to continue technical developments in visual science so that optometrists would always aid their patients with the finest possible refractive science and thus do their full part on the health team serving the public.*

Dr. Hofstetter discussed the need for an overall study, made by an independent research foundation, of optometric education and present day educational facilities, to get a better understanding of our strengths and weaknesses and to aid fundamental educational planning for the future. Medical and dental schools and colleges have each had one such study and Dr. Hofstetter pointed out that they benefited from this research and it is now time for optometry to initiate the requests for this important and timely step in optometric under-graduate professional education in the public's best interest. See pages 50-57.

At the annual election of officers the Academy re-elected Dr. Robert W. Tubesing, Richmond, Indiana, president and the following officers and members of the Executive Council: Dr. Lawrence Fitch, Philadelphia, vice-president; Dr. Carel C. Koch, Minneapolis, secretary-treasurer; Dr. John D. Perry, Jr., Winston-Salem, North Carolina, immediate past president and Dr. Ralph E. Wick, Rapid City, South Dakota; Dr. Donald A. Springer, Anniston, Alabama; Dr. J. Donal' Kratz, Souderton, Pennsylvania and Dr. Monroe J. Hirsch, Ojai, California, members of the Executive Council.

The attendance at all educational meetings was good. More than 200 optometrists enrolled in 2,450 hours of post-graduate courses and 225 Academy members were registered for the Academy convention at the Drake; while 450 optometrists were in attendance at the Illinois Optometric Association meeting at the Morrison. In addition, many senior students in professional undergraduate courses at Illinois College of Optometry, Chicago; the Division of Optometry, Indiana University, Bloomington, Indiana, and the School of Optometry, Ohio State University, Columbus, took part in both convention programs. Many of the papers which were presented will appear in coming issues of this Journal.

*To be published in a later issue.

San Francisco was selected as the convention city for 1960. The hotel selection was the Palace. The 1958 meeting will be at the Statler Hotel in Boston, December 3-9, and the 1959 meeting will return to the Drake Hotel in Chicago. Academy members in both Philadelphia and Denver invited the Academy to hold its 1962 convention in their cities.

Because of the wide spread need, as well as demand, for authentic well prepared home study courses, the Executive Council authorized its sections and committees to undertake the preparation of course material to be offered the profession in the future. The first suggested course will deal with the subject of glaucoma and the optometrists responsibilities in screening patients that may have evidences of this condition. All screening tests, signs and symptoms will be reviewed in detail and the techniques of making these tests will be covered, step-by-step, in this initial course. As these courses become available, they will be announced in this publication.

The Alberta Chapter, American Academy of Optometry, received its charter at the Chicago meeting. Dr. Ralph LeDrew, Edmonton, acting on behalf of the Chapter members, received the charter from Dr. Lawrence Fitch, who, in addition to his duties as Academy vice-president, also serves as chairman of the Committee on Chapters.

During the meeting Dr. Harold Simmerman, chairman of the Committee on Admittance, and his committee members assisted a group of applicants in finishing their requirements. Later these men were elected to Fellowship. The Academy welcomes these new members.

Dr. Donald S. Andrews, Gladstone Medical Center, 5810 N. Milwaukee Avenue, Chicago, Illinois.
Dr. Alfred I. Aron, 2221 Fulton, Houston, Texas.
Dr. Thaddeus W. Bartles, 2 Riverside Avenue, Bristol, Connecticut.
Dr. Saul V. Becker, 1132 Main Street, Peekskill, New York.
Mr. Cyril Leslie Billson, 5 New Market Street, Ayr, Scotland.
Dr. Joshua Breschkin, 107 West Saratoga Street, Baltimore, Maryland.
Dr. Thomas F. Brungardt, 815 United Building, Salina, Kansas.
Dr. George Herbert Crozier, 3022 Frankfort Avenue, Philadelphia, Pennsylvania.
Dr. Robert J. Davis, 129 N. Elm Street, Henderson, Kentucky.
Dr. Ramie B. Dick, 1002 W. Washington Street, Sandusky, Ohio.
Dr. Francis P. Drohan, Jr., 309 Professional Building, Jacksonville Florida.
Mr. Arthur A. Eastman, Visual Research Specialist, Lamp Department, General Electric Company, Nela Park, Cleveland, Ohio.

Dr. Jass Boyd Eskridge, College of Optometry, University of Houston, Houston, Texas.
Dr. Duco I. Hamasaki, 1648 Bancroft Way, Berkeley, California.
Dr. John William Hier, 903 Marquette Avenue, Minneapolis, Minnesota.
Dr. M. M. Honeyman, 21620 Grand River Avenue, Detroit, Michigan.
Dr. Milton J. Kalfa, 99 Pratt Street, Suite 617, Hartford, Connecticut.
Dr. Jack Thomas Keith, 1185 S. Main Street, Akron, Ohio.
Dr. E. J. Kienast, 8904 56th Street, Tampa, Florida.
Dr. Robert A. Koetting, 4196 Manchester Avenue, St. Louis, Missouri.
Dr. Meyer Malkin, 60 Park Street, Rockville, Connecticut.
Dr. Jack A. Mauro, 6 Birch Lane, Scotia, New York.
Dr. Robert W. Moore, 1034 Lowry Medical Arts Building, St. Paul, Minnesota.
Dr. Robert C. Mueller, 515 W. Reed, Moberly, Missouri.
Dr. Jared P. Nessett, Wolfe Eye Clinic, Masonic Temple, Marshalltown, Iowa.
Dr. B. B. Parks, 204 E. Coffee Street, Greenville, South Carolina.
Captain Donald Graves Pitts, 1204 S. Lincoln Street, Bloomington, Indiana.
Dr. Frank M. Root, 412 Main Street, Cedar Falls, Iowa.
Dr. Morton D. Sarver, 5651 College Avenue, Oakland, California.
Dr. A. F. Senaldi, 120 Lexington Avenue, Passaic, New Jersey.
Dr. Robert J. Shea, 67 Chestnut Street, Springfield, Massachusetts.
Dr. Irvin H. Treiser, 24 Hamburg Avenue, Sussex, New Jersey.
Dr. R. H. Tubesing, 1610 N. Auburn Avenue, Speedway City, Indianapolis, Indiana.
Dr. Byron E. Wentz, 367 E. Main Street, Morehead, Kentucky.
Dr. Charles Russell Wolf, 903 Marquette Avenue, Minneapolis, Minnesota.
Dr. Paul N. Youngdale, 402 N. Spring Street, Beaver Dam, Wisconsin.

The interwoven meetings of the Academy and the Illinois Optometric Association—the active part played by officers of the A.O.A. and the O.E.P. in Academy affairs again served to emphasize the unity which exists today within optometry. The large body of optometric visitors to Chicago, displayed a oneness of purpose in further advancing the profession and, at the end of a fine week, the expressions of pleasure were heard on every hand and the determination to make 1958 an outstanding year in optometry was evident.

CAREL C. KOCH

SPECIAL REPORT

A COMPREHENSIVE SURVEY OF THE ROLE OF OPTOMETRY AND ITS EDUCATIONAL NEEDS*

Henry W. Hofstetter†
Division of Optometry, Indiana University
Bloomington, Indiana

The topic of this talk is a matter very close to my heart. It is a theme which I have pursued from every conceivable direction from the day in December, 1945, when a proposal was made for a comprehensive survey of optometric education by Dr. Glenn A. Fry at a meeting of the Association of Schools and Colleges of Optometry in Columbus Ohio. The need and potentialities of this type of study have never since ceased to envelope every phase of my thinking on matters that pertain to optometric education and the role of optometry in society. If in this 12 year interim I have failed to inject this idea at least a thousand times into conversations about optometry with optometrists and others in all walks of life I would be surprised indeed. So may it be understandable to you here tonight that when I was given this opportunity to present my theme one more time, at this meeting of optometric leaders and thinkers, I did not delay acceptance of the invitation one instant.

A short time ago I came across a publication entitled "Professional People,"[1] a very sophisticated study of the trials and tribulations experienced by the members of a good many groups now regarded as professions, written by two Britishers, Roy Lewis and Angus Maude. The first chapter is entitled "What Is Happening?" and the first paragraph of this chapter is so percipient of our thoughts in optometry that I cannot refrain from quoting it in its entirety: *"To be a professional* man or woman today is to live with uncertainty. For those who, progressing from secondary school to technical training, or correspondence college, have achieved recognized professional status from a family background of manual labor, this uncertainty may be blended with the hope that drew them on. But for others, and in particular for that

*Read before the annual meeting of the American Academy of Optometry, Chicago, Illinois, December 9, 1957. For publication in the January, 1958, issue of the AMERICAN JOURNAL OF OPTOMETRY AND ARCHIVES OF AMERICAN ACADEMY OF OPTOMETRY.

†Optometrist, Ph.D., Director of Division of Optometry, Fellow, American Academy of Optometry.

almost hereditary professional aristocracy which is a peculiarly British institution, the dominant component is uneasiness, if not actual fear.

It has often seemed to me that it is just such an atmosphere of fear and uncertainty that has given rise to the flurry of broad studies of many professional and vocational groups, starting with the Carnegie sponsored Flexner[2] report on medical education in 1910 and continuing with a rapidly increasing series of comprehensive studies on the educational, social, and civic aspects of every endeavour that could be regarded a legitimate professional pursuit. Some of these have been projects of self study, sometimes, but not always, supported by outside funds, and others have been studies entirely controlled by and sponsored by outside agencies or foundations. Optometry stands virtually alone among the numerous professions and vocations of today in respect to the fact that it has not vigorously sought, nor even encouraged, such a study in its own behalf on a national scale. This distinction for optometry was brought to my attention most vividly a few months ago at a meeting of the Association for Higher Education when a well-informed official of the U. S. Department of Health, Education and Welfare stated that, so far as he knew, there were only two important groups left who had not been given adequate study—optometrists and farmers!

What has been the guiding spirit in these studies? Here I can do no better than to refer to one of the great endowed foundations responsible for underwriting much of the study made in a sister profession, Dentistry. Let me quote from the most recent brochure[3] and statement of purpose of this foundation:

". . ., the Foundation has the philosophy that the Foundation itself does not have problems or programs—that people, agencies, institutions, communities, states and countries have problems to solve and programs to develop. If they are sincere, have a constructive plan, and are willing to apply some of their own effort and resources toward the solution of a problem, careful consideration is given to proposals for assistance. A guiding principle is, 'Help people to help themselves.'"

What encouragement has optometry ever given to such a study? I am happy to be able to say that not all of optometry has been negligent in this pursuit. In June, 1954, the first official expression was given in request of such a study by the Association of Schools and Colleges of Optometry.[4] The unanimously adopted resolution reads as follows:

"WHEREAS, there are basic problems in optometric education that relate significantly to the general design and purpose of higher education; and

"WHEREAS, there is need to define the purposes of optometric education more

clearly in terms of the public need for professional services in the field of vision; and

"WHEREAS, the analysis of the problems and the formulation of the purposes by a committee of persons cognizant of the role of higher education in the professions, and of the scope of visual science, would provide guidance of inestimable value in the continuous and future design of optometric education; therefore be it

"RESOLVED, that the Association of Schools and Colleges of Optometry endorse in principle an invitation to an appropriate foundation or agency to make a comprehensive study of the field of optometric education in relation to the public need for professional optometric services, the scope of optometric services, and the integration of optometric education with related phases of higher education generally; be it further

"RESOLVED, that an appropriate agency, foundation, or committee shall be considered as one removed from the self interest of the optometric profession or any other profession having an indoctrinated interest in professional visual sciences; and be it further

"RESOLVED, that the Executive Committee of the Association of Schools and Colleges of Optometry convey to one or more appropriate foundations or agencies this expression of principle."

Later in the same year the Executive Council of the American Academy of Optometry endorsed this resolution by written ballot.

With these endorsements in hand, your speaker, as then president of the Association of Schools and Colleges of Optometry, contacted three major foundations, the Carnegie Corporation, the Fund for Education, and the W. K. Kellogg Foundation, and in addition sought the counsel of the Assistant Commissioner for Higher Education of the U. S. Office of Education.

It must be obvious to you that we were not successful in initiating a study. It is of course very possible that this failure represented a lack of sales ability on the part of your spokesman. This however I am not prepared to concede, though, for the sake of greater success, I would have been delighted to see someone else take the initiative in these negotiations. In fact, I would not even be willing to concede that the effort was truly a failure, for in my negotiations there were always apparent certain handicaps which I could not surmount in an honest presentation of our request. These I would identify as follows:

1. The request reflected the wishes of only a very small and restricted segment of optometry.
2. The request was not supported by any tangible evidence that optometry was willing to apply some of its own effort and resources.
3. We could not submit a plan of operation that would insure even reasonable cooperation of the many professional agencies that would have to assist in supplying information.

In other words, to paraphrase the previously quoted principle of a great foundation, it did not appear that optometry was ready to be helped to help itself. Needless to say I was enthusiastically and sympathetically encouraged by every agency contacted to push on with my mission.

Within the past year another segment of American optometry has put forth a demand for a study of optometric education and related factors, this time by the influential Southern Regional Education Board representing the interests of 16 southern states in education for the professions. In this instance the 4,000 optometrists of the constituent southern states were nobly represented by its own regional organization, the Southern Conference on Optometric Education. I am sorry to say that the lack of success by this group has been for a different but highly significant reason, namely, the declared opposition by the ophthalmological contingency of the medical profession.

Such opposition, in my opinion, strikes at the very heart of the total issue. It makes crystal clear the proposition that there is vastly more involved than professional pride and professional self interest. The matters to be included with this issue involve moral, political, social, civic, economic, and educational problems affecting the welfare of a whole nation of citizens. The failure of optometry to pursue vigorously a public and unprejudiced clarification of its educational objectives and its role in society in the light of these experiences and in full knowledge of the malicious attempts of other groups[5, 6] to undermine its existence constitutes, in my opinion, an act of gross professional delinquency.

So much for the introduction of my theme. What, you may well ask, would be some of the areas and problems to be studied in a comprehensive survey of the type proposed? Here are but a few that I can suggest:

1. The historical background and development of the profession.
2. Our professional aims and ethics.
3. The political and scientific organization of the profession.
4. Optometry and related ophthalmic practices in other countries.
5. Relevant statutory regulations.
6. Procedures and practices of examining and licensing boards.
7. The number, distribution, and supply of optometrists.
8. The scope of optometric service.
9. The prevalence of visual anomalies in the general population.
10. The development of optometric schools and colleges.
11. The optometry curriculum.
12. Academic degrees and professional titles.
13. Post-graduate education.
14. Vocational opportunities for graduates of optometry curricula.
15. The economic problems of the profession.
16. The character and role of optometric periodicals and professional publications.

17. Relevant facts concerning medical eye practitioners.
18. Relevant facts concerning dispensing opticians.
19. The role of manufacturers and distributors of ophthalmic supplies.
20. Relevant facts concerning the vision cults.

Next we might ask, where would the needed information be obtained? Naturally, a great share of the information would have to be obtained by interviews, conferences, correspondence, office-to-office surveys, and the review of optometric and related literature. Other sources of information include the offices of such organizations as the Association of Schools and Colleges of Optometry, the American Optometric Association, the American Academy of Optometry, the International Association of Boards of Examiners in Optometry, the National Board of Examiners in Optometry, the Optometric Extension Program Foundation, the Southern Conference on Optometric Education, the American Optometric Foundation, the American Medical Association, the American Academy of Ophthalmology and Otolaryngology, the National Society for the Prevention of Blindness, the Guild of Prescription Opticians, the Optical Wholesalers National Association, the Association of Independent Optical Wholesalers and the Optical Manufacturers Association.

Such a list immediately brings to mind numerous other sources of pertinent information. I trust, however, that those already mentioned will serve to illustrate the extensiveness and thoroughness of the kind of survey I would propose.

Finally, let me answer the question, what, specifically, can the assembling and collating of such information accomplish? This can be answered briefly by listing some of the basic objectives in two broad categories as follows:

1. To collect and organize information useful as a reference and guide to:
   a. Institutions of higher education conducting courses of study in optometry or contemplating the establishment of a curriculum in optometry.
   b. Academic accreditation agencies.
   c. Vocational guidance agencies.
   d. Agencies representing sources of financial aid for education and research.
   e. Legislators concerned with laws regulating the profession.
   f. Military, industrial, governmental, civic, and social agencies

concerned with the employment of optometrists and optometric service.

g. The various professional and scientific organizations in optometry.

h. Students of sociology, economics, and education.

2. To make general and specific observations, criticisms, suggestions, and recommendations to guide the profession itself and such other agencies and organizations as may have a direct influence on the development of the profession. The areas in which the need of guidance is most apparent include:

a. The design and length of the optometry curriculum.

b. Adoption of a uniform professional title or degree.

c. Criteria of accreditation.

d. The role and future of our present schools and colleges.

e. Student recruitment.

f. Evaluation of graduate programs to qualify optometric teachers and researchers.

g. Sources of financial support for optometric education and research.

h. State board examinations and licensure.

i. The role and responsibilities of the optometrist in the visual care of the public.

j. Economics of the profession.

Now you may ask, what about the aforementioned uncertainties and fears that we apparently share with the members of other professions? What about some of the aspects of our profession that make us blush, at least among ourselves? How will the symptoms of commercialism in our ranks be interpreted? Will this more than 300 year old profession stand up under the close scrutiny of a committee searching for the faults as well as the merits of our existence? Might not those assigned to help us help ourselves merely help us to extinction? If these and a dozen other questions are bothering you, let me but ask in return, how has optometry traditionally fared when judged by men of stature and integrity in the light of all the available facts? Consider the decisions of the legislatures throughout our land and in other countries in the development of our statutory regulations. Be encouraged by the repeated affirmations of optometry's role as a profession before the courts of law. Be mindful of the many decisions of great educational institutions to provide optometric courses. Recount the innumerable instances of support and almost phenomenal loyalties among your own acquaint-

ances who out of sheer curiosity learned all they could about the profession of optometry. Remind yourselves of the flattering conclusions repeatedly drawn by high school and college students writing on optometry as a topic for a theme. Indeed, if you could but read the hundreds of statements that I have read on "Why I want to become an optometrist," you, too, might wear the oversize headgear that I wear. Then realize that all of these endorsements of the role of optometry in our society blossomed forth in an environment pervasive with discriminatory prejudices and bombarded relentlessly with adverse propaganda. Yet more important in your evaluation of the significance of these heart-warming endorsements must be the realization that they came about only when those acquiring these convictions were given access to all of the available facts.

Many of you here tonight know me as a severe critic of optometry, as one who has, all too frequently for your pleasurable complacence, made candid statements concerning optometry and optometrists for all the world to read and hear, as one who has experienced and voiced frequent disappointment in matters of optometric policy and action. Some of you have been shocked by my frank discussion of optometry's problems with persons outside of our field, yes, even with persons that some consider irreconcilable enemies. Others of you believe that I live in an ivory tower where I cannot observe the worst of the profession as well as the best, though in believing this you must nevertheless know in your more realistic moments that I would have to be totally blind and stone deaf to accomplish this. Those of you who know me by these attributes alone may, therefore, wistfully conclude that I am a hopeless optimist, if there be such. This, by all the powers of self analysis that I can muster, I am not.

On the contrary, I am only aware that as I learn more and more facts about the profession of optometry and its role in society I become more and more convinced that what is needed most desperately for the benefit of all concerned is that the public, though the eyes of its most percipient citizens, pause a moment and take a good long look at us.

Briefly, then, this should conclude my dissertation for this evening. Nevertheless, I know there are many who feel that we already have the necessary information at hand, and that we can continue the remarkable advancement of optometry by sheer determination and brute force, by the sheer strength of our own convictions of its important contribution to society. This is an admirable opinion, and one which I hope that I may never discourage. But in my own mind, and let me remind you that I have spent no small part of my career studying the very

problems that I am now proposing for study by less prejudiced persons. I am continuously plagued by the suspicion that my own personal knowledge of the profession resembles that in a recently published essay of a Brazilian third grader[7] concerning a very familiar domestic animal, the cow. May I read it to you in its entirety.

"The cow is a domestic mammal. It has six sides. Top, bottom, right, left, front, and back. In front is the head. It has horns where there is room for the mouth. The horns are to butt with and the mouth to moo with. The cow is covered with cowhide. Underneath it has a box of milk, it's made for pulling, nobody knows how the cow does it. Behind, it has a tail with a brush. With it the cow bats flies and they fall in the milk. The cow also makes a calf every year. Nobody knows how she makes it, my brother Joao says he knows. The cow smells good, you can smell it from far off. That makes the smell of the country. The cow's husband is the bull. He does not have milk underneath so he's not a mammal. To call someone a bull is bad. The cow eats potatoes and grass and the calf eats macaroni. She doesn't eat much, she eats again what she ate before. When she eats, she swishes her tail and the food comes up into her mouth again and she eats until she's not hungry any more. When the food is good, the milk is good, but when the food is bad the cow's milk is bad. When it thunders it's sour. That's all I know about the cow."

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BOOK REVIEWS

THE PROBLEMS OF VISION IN FLIGHT AT HIGH ALTITUDE. Thomas C. D. Whiteside, Ph.D., M.B., Ch.B. Published for and on behalf of The Advisory Group for Aeronautical Research and Development, North Atlantic Treaty Organization, by Butterworths Scientific Publications, London. 162 pages; illustrated. Distributed by Interscience Publishers, Inc., New York, N. Y. Price $5.00.

The author, who is associated with the University of Glasgow and the Royal Air Force's Institute of Aviation Medicine, has combined his own personal experiences with those of experienced pilots to bring to the reader an excellent account of some of the major visual problems associated with flight at altitudes between 10,000 and 40,000 feet.

The book may be considered as comprising two sections: one dealing with the physical and physiological factors affecting visibility within the cockpit, and another concerned with the physiological factors affecting air-to-air visibility. A brief review of the history of aviation, an account of the beginnings of aviation medicine, and a short review of visual problems, old and new, provide an interesting introduction.

In order to determine the cause of the oft times reported problem of reading instruments in shadow at high altitude, the author describes a series of experiments, both in the laboratory and at altitude, concerned with: contrast between light and shade, fluorescence of the crystaline lens, intra-ocular scatter, anoxia, and glare. It is concluded that the subjective haze at altitude, causing difficulty in reading instruments, is due to persistency of the positive after-image of the bright cloud floor caused by low-grade anoxia. An anti-glare visor is also of value in decreasing veiling glare at altitude.

The problem of air-to-air visibility is investigated in terms of "space myopia" by subjective and objective measurements of accommodation while viewing an empty visual field. It is shown that accommodation fluctuates between 0.5 and 2.0 diopters under these conditions.

This book should be of particular interest to those optometrists, ophthalmologists, and flight surgeons engaged in caring for the vision of military and civilian air crews.

FLOYD M. MORRIS, O.D.
MAJOR, USAF, (Medical Service Corps)

DIVISION OF OPTOMETRY
INDIANA UNIVERSITY
BLOOMINGTON, INDIANA

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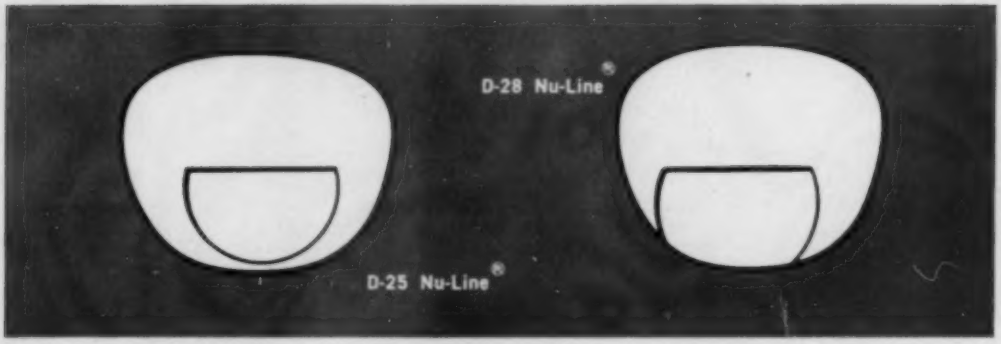

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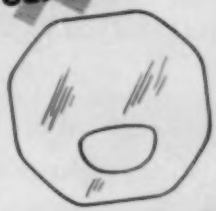

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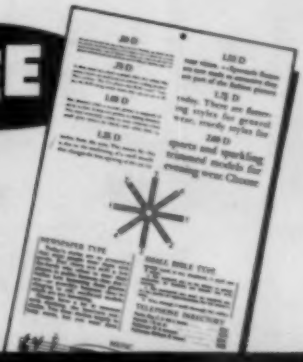

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